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OPHTHALMOLOGY
AND
OTOLOGY.

IN CONJUNCTION WITH

DR. E. GRUENING, OF NEW YORK, AND DR. CL. J. BLAKE,
OF BOSTON.

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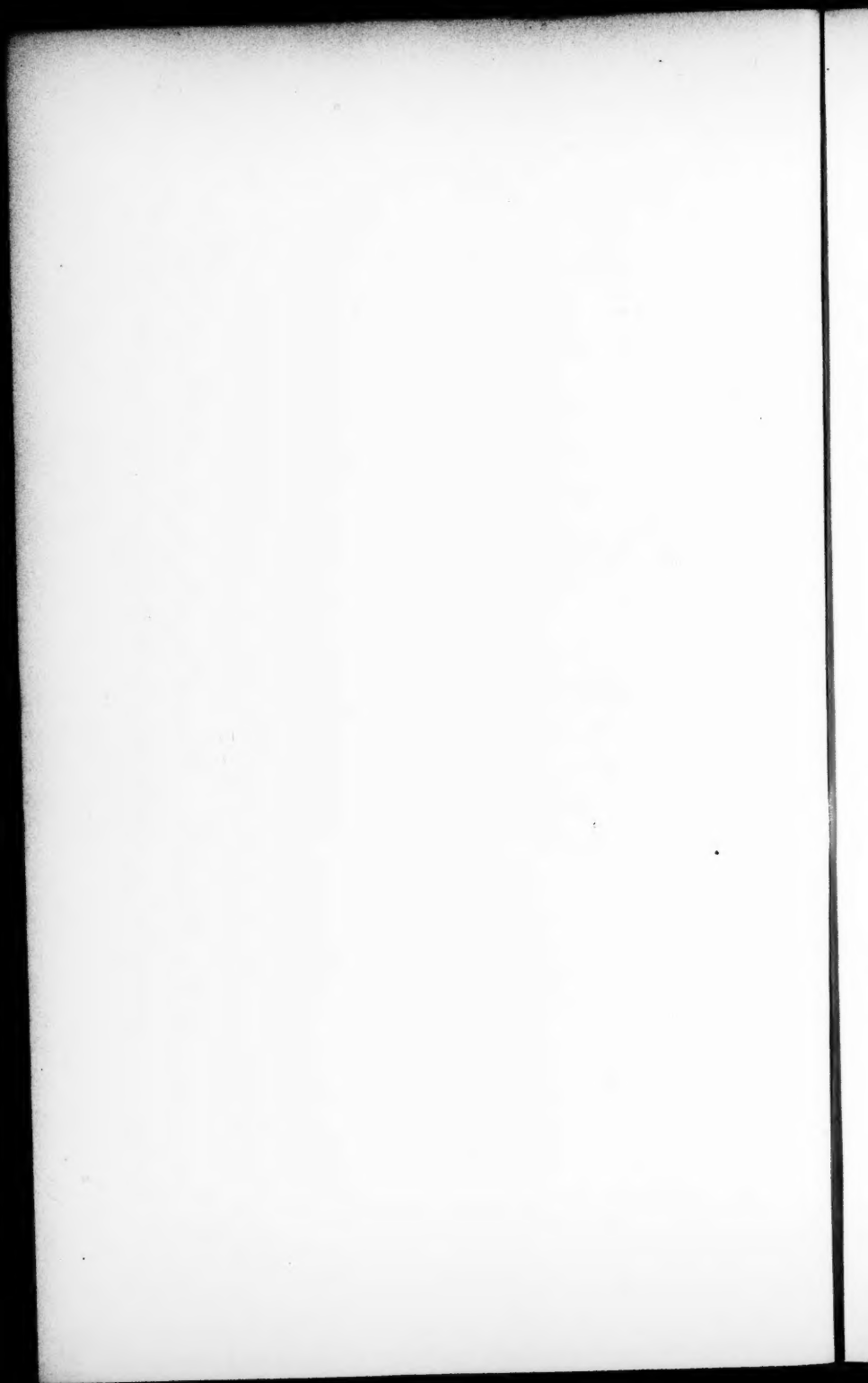
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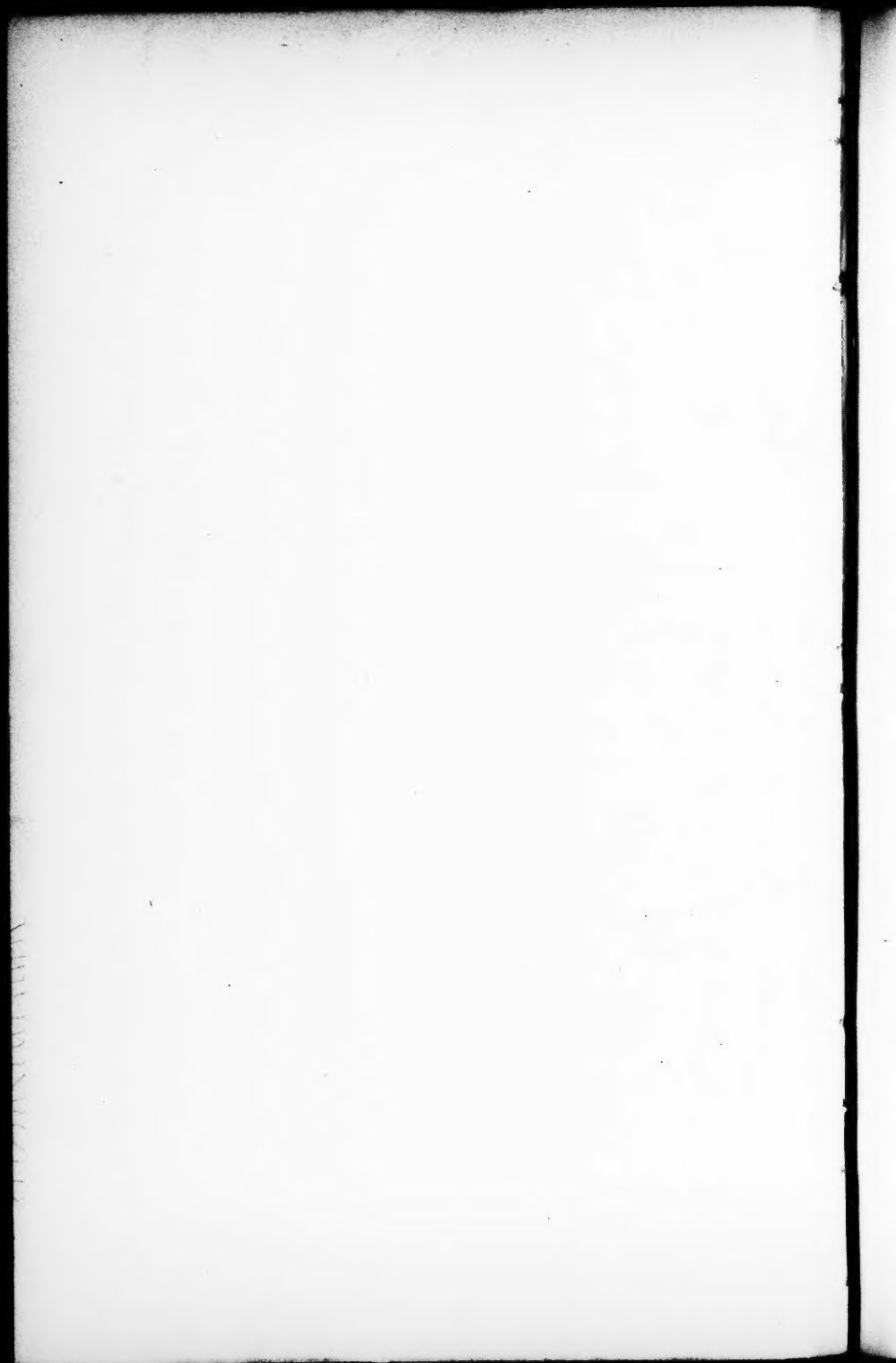
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OPHTHALMOLOGICAL PART.



FURTHER INVESTIGATIONS ON KERATITIS.

By S. STRICKER.

(With Plate I.)

(Translated by Dr. C. S. Bull, of New York.)

THE investigations which form the subject of this paper were not undertaken for the purpose of determining the origin of pus-corpuscles, for my former views on this subject I regard as so firmly established that further investigations in that direction seem to me useless. It also seems to me that the principal theory, which I have defended for a number of years, namely, that the normally branched and immovable cells become movable in keratitis, divide, and therefore produce pus-corpuscles, has gradually gained more advocates and defenders.

During the last year, however, the nature of suppuration has been forced upon my attention from another aspect, and this has necessitated a further investigation.

This aspect of the process is as follows: The corneal corpuscles ramify in different directions, and by their processes form a network. Each corneal corpuscle is the nodal-point or centre of a more or less highly developed meshwork; and since the terminal branches of every meshwork unite with the terminal branches of the neighboring networks, the general appearance of the entire cornea is as if it were traversed by one great network. Whether the ends of the processes merely are in contact, or whether they actually blend with one another, is a matter which I must still leave undecided.

When the inflammation begins, these processes swell, and the meshwork becomes coarser.

As the inflammatory process becomes more developed, the swelling becomes greater. The cornea at the focus of inflammation is now traversed by a thick meshwork.

This condition I have regarded as the stage of inflammatory swelling and infiltration.

The meshwork, however, is composed entirely of cells and cell-processes. But since both cells and their processes divide, the meshwork assumes a mosaic structure.

By division I do not here mean the actual separation, but only the formation of lines of demarcation between individual sections of a cell or a process, which can be rendered distinguishable by silver.

This kind of division (carried out by experiment) is in the animal world by far the most frequent. When the egg divides, the divisions do not separate. The furrowed egg consists of segments which adhere to one another. The skin, all the mucous membranes, all serous membranes consist of cells, which have resulted from such divisions, where the cells remain adherent to each other, and yet are divided from each other by walls, which are rendered visible by silver.

The meshwork of the infiltrated region is therefore composed of segments like a true cellular tissue. Figs. 2, 3, and 4, Plate I., represent just what I have described, and on these preparations I base my views.

As the meshwork and its branches swell, the basis substance (matrix), which is visible in its meshes, gradually diminishes. Finally, these islands of matrix become smaller and smaller, until they disappear. The mosaic-like meshwork has become a mosaic-like nodule.

Such transformations, however, cannot occur all at once throughout the whole focus of inflammation. We see in Fig. 2 a place in which we can still recognize a network with large meshes as well as nodules. Such a nodule is a mass of cells; a nucleus can be recognized in many of the smaller subdivisions; such a nodule is a focus of suppuration of microscopic size.

If, meanwhile, the remaining portions of the meshwork are similarly transformed, of course a larger nodule is the result.

This large nodule has taken the place of the normal tissue, and when the already-divided, but still adherent cells actually separate and fall apart, the tissue is disintegrated, and suppuration has occurred.

The products of this cell-division of the original meshwork are either pus-corpuscles, or still smaller bodies, and I cannot yet come to a decision whether they are still capable of development, or whether they are merely masses of detritus, which eventually disappear.

The character of the pus varies in accordance with the proportion existing between the very small particles or masses and the real nucleated pus-corpuscles. It sometimes contains but little, at other times much granular matter or detritus.

The transformation of corneal corpuscles into pus-corpuscles, first described, is not the only one possible.

In my first investigations on this subject, which were undertaken in connection with W. Norris,* I showed that there originated in the old tissue isolated wandering cells by the contraction of the processes and division of the branched cells. These are the views which have excited so much discussion, and which, in my judgment, have been of late best described by Meyerowitz,† a pupil of E. Neumann.

I do not propose to enter upon a defence of these views at this time, particularly as they have obtained firm support from another quarter. My only object here is to bring forward new supports for my views upon the suppurative process, by fixing the limits of the methods of preparation as carefully as possible. A slight improvement in method is about all that I have to offer in this article; though I think I have made a not inconsiderable advance in the theory of the process also.

The importance I attribute to my method is, on the one hand, based on the fact that not every animal is suitable for following out the investigations to a satisfactory termination, and that during the past few years the published investigations have been made almost entirely upon animals not adapted to the purpose. I must here repeat what I have formerly pointed out, that the frog is not adapted to the settlement of questions bearing upon keratitis; and to the unfortunate choice of an object must be attributed the long discussions upon the proliferation of the branched cells, which could not otherwise have occurred upon so

* Stricker, Studien, Wien, 1869, p. 1.

† Inaugural Dissertation, Königsberg, 1875, bei Jul. Jacoby.

simple a matter. On the other hand, the investigations upon mammals are not very attractive, because the cornea in these animals is thick, is colored or stained with great difficulty, and sometimes not at all. Yet all these difficulties, I think, can be easily overcome.

Before, however, commencing my short statement, I cannot avoid reminding those who are interested in these studies of a principle of comparative histology, which, if I am not mistaken, was first advocated by Joh. Müller. The principle is as follows : That animal should always be chosen for investigation which is best suited to the purpose. It is evident that this principle should also be our guide, for our task is to study, not keratitis in the frog, but keratitis in general. Therefore, when an observer, as was actually the case, asserts that young cats are best adapted to the study of the process, it is at least not conducive to progress if other investigators subsequently come forward, confine their examinations to frogs, and then consider themselves justified in contradicting the former view ; or from studies entirely confined to the frog's cornea, which they have treated by very different methods, point out where some other investigator has erred in his study of the cat's cornea.

I reiterate, therefore, once more that my new investigations were made upon very young cats (from three to six weeks old), and by certain fixed methods, and I recommend all those who are interested in such matters to convince themselves of the truth of my assertions, and, moreover, obtain most excellent specimens for instruction.

The illustrations which accompany the paper above cited,* are as little suited to demonstrate the beauty of my preparations as are those which illustrate the present paper. The blame for this rests solely on the defects in artistic execution. Just as this paper was passing through the press, I succeeded in obtaining some preparations of such beauty and demonstrative power, that I have had one of them colored by an artist, and hope to have it multiplied by chromo-lithography.

I say in colors, because my preparations sometimes appear in a beauty of color that is quite seductive, and it is therefore better

* *Med. Jahrbücher*, 1874, *Tafel*. XII.

to leave everything to the artist, so that he may produce a true picture of what he sees.

For irritating the cornea, I employed caustic potash instead of the solid stick of nitrate of silver, or the actual cautery, or foreign bodies, as formerly. Although the forms of inflammation produced by foreign bodies or cauterizing agents possess in general a certain common typical appearance, still the different irritants carry with them certain peculiarities. I will not theorize on this matter, for the question of importance is merely one of fact, and that is, that caustic potash always produces in the corneæ of very young cats the appearances which I shall here describe.

It is not necessary to narcotize the kittens before employing the caustic, as they can be controlled very easily. A cloth is to be wound round a kitten, leaving the head free; the eyelids and nictitating membrane are held apart by an assistant, and I then lightly touch the cornea with a small stick of dry caustic potash. It is not easy to keep the caustic potash in a dry condition, and it is therefore well for every one who repeats this experiment to order for himself from some chemical laboratory or apothecary a dry stick of potash in a well-corked glass bottle or holder.

Although only a small portion of the cornea was touched by the caustic, it extends over a much larger space; still the size of the cauterized spot depends, other things being equal, upon the force with which the caustic is pressed upon the cornea, with the proviso that a dry piece has been used.

As it may be desirable to know the exact extent which may be most suitably given to the cauterization, I may mention that the procedure is safest when the cauterization is applied exactly to the centre, so that a free margin of undestroyed cornea, of the width of a fourth, or even a third, of the corneal diameter, remains after the operation. We may then expect with certainty instructive pictures in this marginal zone. On the day after the cauterization, that is, from 20 to 24 hours later, I narcotize the animal, though not with chloroform; such small animals lose consciousness, even when from 0.1 to 0.15 of a gramme of hydrate of chloral in a watery solution is injected subcutaneously. As soon as the animal is asleep, I remove the eyelids, so as to leave the cornea entirely free.

If the cornea be now observed, *the healthy marginal zone is*

seen to be elevated like a delicate fold above the cauterized spot. This unevenness is in part caused by the loss of epithelium at the cauterized spot ; but partly also by the fact that the latter, as we learn from transverse sections, is not so thick as the diseased and inflamed marginal zone. In other words, *the inflamed zone is swollen.*

Although this statement may seem to physicians a very plausible one, and though I may even be blamed for giving so many words to describing the existence of one of the chief phenomena of inflammation, yet I must call still closer attention to this circumstance.

A partial prominence of the cornea stretching over a zone is in itself a rare and remarkable appearance. But it is further to be remarked that the swelling diminishes towards a cauterized spot, in which the corneal corpuscles have been destroyed.

But I will not anticipate my description.

I stroke the cornea with the nitrate of silver in substance once, twice, or three times, until I am convinced that it is colored throughout its entire extent. In my article published before, the question was discussed whether such treatment is permissible, whether it does not give rise to artificial results, and, therefore, I tried the parallel method of coloring the cornea in the living body with solutions of silver. Here I must again emphasize what I have before said, that the coloring of the cornea in the living body must be thoroughly successful if we wish to obtain good pictures. The cornea in the living eye is a very different body from the excised cornea. As soon as the nitrate of silver in substance touches the former firmly, a colorization follows in the deeper layers as far as into the membrane of Descemet itself. Nevertheless, when I say that I stroke the cornea several times, it must be understood that the reason for this is, that the cauterization extends very irregularly into the corneal substance, and that the entire convex surface cannot be touched in one stroke with the hard pencil of silver.

The reagent acts very differently on the dead cornea. It penetrates with extreme difficulty. If we should excise a cat's cornea and place it in a bath of silver, we should scarcely gain our end. Some layers are colored, and even these look very different from those colored in the living cornea. I have, however, entirely

abandoned the much more tiresome coloring of the living cornea with solutions, because I am convinced that even the intense action of the silver in substance, at the worst, only renders the superficial layers useless for examination ; while the deeper layers are most favorable for the purpose. I excise the cornea a few minutes after the cauterization, and lay it in water slightly acidulated with acetic acid.

In this water the cornea swells the inflamed portions more than the cauterized, and we have now to decide whether we will make lamellar preparations or transverse sections.

If, after the cornea has remained about twenty-four hours in acidulated water, we place it in alcohol, we obtain after a few hours a preparation, which is, perhaps, better fitted for making sections than any other tissue. Sections may even be made on cork or turnip without the necessity of embedding them. The consistence of the cornea in this state resembles that of a very delicate cartilage. The advantage, however, here is, that we can graduate the consistence accordingly as we leave the cornea longer in the acid or longer in the alcohol. If we wish to make lamellar preparations, we proceed in accordance with the methods before given.*

I must, however, in the face of more recent statements, once more emphasize the fact that a cornea colored in gold by no means offers the advantages for lamellation which we gain from a cornea colored with silver in the living eye. I must further mention that it is unwise to be in too great haste in making lamellar preparations. The cornea must lie two days, and even longer, in acidulated water, and must then be carefully and thoroughly cleansed from the acid before lamellation can be undertaken with certainty of success.

The studies of this year have also in great part been made on lamellar preparations. I have, indeed, used transverse sections for the purpose, but the time was lacking for representing with accuracy the complicated pictures afforded by the sections. In one sense, however, they were of service to me in elucidating certain points in the suppurative process, and I shall take occasion to report the results so obtained.

If we examine a lamella of such a cornea with the naked eye,

* See Wiener Med. Jahrbücher, 1874, pp. 380, 384.

or better still, with a magnifying glass, as is seen in Fig. 1 (Plate I.), we recognize immediately that a marginal zone is sharply defined from a central part by differences in color and texture.

If we employ higher magnifying powers, we see that in the central part the corneal corpuscles, and also the network, are still recognizable; but they evidently bear the impress of the cauterization. They are very pale, not sharply defined, granulated with tolerable uniformity; the nuclei are easily recognized, but sometimes these are merely surrounded by a heap of granules, without processes, as may be seen in Fig. 2 at *ccc*.

Not a trace of new formation is discernible. Neither rudiments of wandering cells nor divisions of the existing network, or of the corneal corpuscles, are to be seen. Moreover, the pictures are the same, whether the cornea be excised immediately after the cauterization or later.

The corneal corpuscles are destroyed by the potash, and no matter how large the cauterized region may be, it is, with the exception of the marginal zone, free from pus. There extends through it the uniform picture of the substance proper interspersed with destroyed cells, generally with a single nucleus.

How different is the picture at the margin where the corneal corpuscles were not cauterized! The contrast is rendered most marked by the multiplicity of colors which already prevails here. It is true that these differences only appear after the lamella has lain quiet a few days, and I must here again remark, that the preparations are destroyed if they are exposed to a bright light. But in preparations which have been preserved in a box for some days, the differences in color stand out beautifully. Where the silver has affected living cells, the color-shading is extremely varied, and it would seem incomprehensible how the silver could produce such differences in color, if we did not know that here the living cell plays its part, that the varying chemical action leads to very different chemical combinations with the silver, and finally to very different mechanical arrangements of the precipitates in different cells.

Neither every preparation nor all parts of a preparation are suited for the elucidation of the process. In many the suppuration is too profuse, in others a decolorization has appeared; in

short, the process is not so distinctly recognizable in them as could be desired.

There is, however, scarcely to be found a cornea prepared in this way, in which we cannot meet with at least *one* good lamella. I call the preparations good in which, as is shown in Fig. 2, by low magnifying power, it is perfectly evident that the corneal network has become divided, the basis substance in places diminished, in other places has entirely disappeared, so that the history of suppuration can be read upon a single surface, as I pointed out during the past year.

We cannot employ the higher magnifying powers for every picture which offers a fine general survey of the process. I cannot fathom why the nuclei in the divided segments often stand out beautifully, and again cannot often be seen in spite of the most exquisite picture of segmentation. In Fig. 4, for example, is a preparation magnified 500 times, where the nuclei are distinctly visible in each segmentation. In the preparation which I am about to have repeated in colors, no nuclei are to be seen. Segmentations in which nuclei are plainly visible are particularly adapted for high powers, and such a segmentation often lies in the middle of a focus of inflammation which is otherwise perfectly useless, and which therefore affords no good view for general survey.

In my description of last year I have asserted that wandering-cells form round the slough of cauterization, but that this does not necessarily lead to a suppuration of the tissue. The true suppuration I have also described, but I could not define exactly how this could surely be found. I had fine preparations lying before me at the time, but I could not state with certainty under what circumstances this definite form of tissue change appeared. This I can now do. In very young animals cauterized with potash the appearance is a regular occurrence. If islands with isolated wandering-cells are occasionally met with at points which are not suppurating, that is, where there exists no network in the brown-colored substance proper, but only isolated unbranched cells, these are exceptional, and in fine are met with in connection with those pictures of inflammation and suppuration which are of such importance to us just here.

Here, therefore, in the certainty of the directions for making

the preparations, I think I have made a slight advance in method, and I must lay so much the more stress upon this point, since there is need of vantage ground for a new view of the subject.

The altered method of preparation has also led me a step farther in theoretical knowledge, as has been already mentioned.

1. First, it has become evident that the suppurative process ceases at the line where the living branched corpuscles border on the dead cauterized tissue.

My attention will no doubt be called to the fact that this is a necessary claim of the theory which I have for years advocated. But this is now in accordance with the expressed views of all authors, opponents as well as adherents of this theory.

Finally, it will be said that this was a point always tacitly admitted, that the suppurative process was confined to the living tissue, and did not involve the dead elements.

As a matter of fact, however, this is a point which does not go so entirely without saying. For if the nature of suppuration is determined by the inwandering of foreign elements, it is inconceivable why the dead portions which still adhere to the living should not also suppurate. But it will be objected that the wandering-cells cannot penetrate into the dead tissue, because all the paths thither are blocked up by the coagulation caused by the caustic. This objection I have tested.

I cauterized a frog's cornea through and through with caustic potash, excised it, and immediately introduced it into the pocket of the nictitating membrane of the other side, in accordance with a method already recommended.* The next day I withdrew this cornea and examined it in the fresh state, and found its marginal zone strewn with numerous pus-corpuscles, as every other cornea treated in this way would be.

I have, moreover, adopted other courses, since the cat's cornea is but little suited to such experiments, because in its fresh state no good examination of the wandering-cells can be made on account of its thickness. I have inserted the point of a Pravaz' syringe

* Studien, pp. 33, 34.

into the disintegrated regions of the living cornea, and injected particles of carmine or cinnabar, and have seen the fluid with the particles everywhere penetrate easily and spread out in different directions.

The destruction of the cells by cauterization with potash by no means therefore does away with the possibility of inwandering. If, however, the cauterized region of the cornea still *in situ* remains free from pus, this is always of some value for the theory.

When I say "free from pus," I mean, of course, "generally speaking," or "on the whole" free from pus. For I am not able to determine whether certain corneal corpuscles do or do not send processes into that portion of the disintegrated region which they touch with their ends or prolongations; or whether certain isolated wandering-cells, which are occasionally found on the margins between disintegrated cells, have not wandered in there. The matter has two sides. It may be that the cauterizing agent has pressed forward irregularly at the margin of the cauterized zone, and has left living cells between the disintegrated ones. Or it may be that the line of demarcation of the disintegrated cells was sharply defined, and the network, which is amœboid at the margin, sent forth processes beyond it. As a matter of fact, the line of demarcation separating the purulent zone from the disintegrated one is irregular. Fig. 2 gives a true representation of such a point, at least in contour; *b b b* corresponds to the periphery of the cornea, *a a a* the divided tongues stretching into the dead tissue. Every one may now adopt the interpretation which best pleases him; it can have no further influence upon my statement.

2. Not only the suppuration, but also the swelling of the tissue is limited to that zone in which the corneal corpuscles are still alive. I have already called attention to this in the introductory discussion. We gain a much clearer idea of this swelling and the difference between living and dead tissues by making lamellar preparations. Every lamella is thicker in the suppurating zone; this can be seen under the magnifying glass, while the layers are being stripped off; it is perceivable when we seize hold of the lamella in different places with the forceps. The cause of this swelling is as clear as possible. The substance of the cornea proper has but little to do with it. At the point where

the swelling is thickest, the basis substance is thinnest, while the cellular network is, on the contrary, swollen. In my former publication I made the statement, based solely on inspection of the microscopic pictures, that the swelling of the network determined the nature of the inflammatory swelling, the nature of the inflammatory infiltration ; and this I must now repeat, after a comparison of the microscopic pictures with the macroscopic and with those given by an ordinary magnifying glass.

By grouping together the two propositions, the subject may be presented in the following condensed statement : *The inflammatory swelling and the suppuration are limited by the line of demarcation which exists between the living cells and the dead ;* and if my evidence is firmly established, this can always be regarded as a slight expansion of the theory.

Those who know the history of this theory will immediately recognize that I have reached a point which was prevalent ten years ago. For the inflammatory swelling and opacity of the cells was actually a watchword of the theory of inflammation then prevalent. In fact, the principles of the whole subject, which I have defended since 1869, are by no means new. Still my present standpoint is very different from that which prevailed ten years ago. While the idea, based upon the existing cellular theory, was formerly maintained, that the hollow branched cells produced pus endogenously, I affirm that the branched immovable cell returns to an embryonic state, contracts its processes, becomes amœboid and divides, or swells up *in situ* together with its processes, and then divides. While the swelling was formerly regarded as the result of diffusion in tubular structures, I now assert that the protoplasm swells, becomes softer, divisible, and amœboid.

The main thought which runs through these views of mine is therefore, 1. *That the swelling of the branched corneal corpuscles determines the nature of the inflammatory swelling as well as of the inflammatory infiltration ;* 2. *That infiltration does not mean suppuration, but merely one of its preliminary steps, a step from which a return to the normal condition by diminution of the swelling is conceivable.*

The tissue is infiltrated with the still undivided substratum of

purulent formation. The infiltration may disintegrate into pus, but in the beginning it is certainly not pus.

My assertion is based solely upon observations on the cornea, and I can only refer it to them. I must, however, remark that *Meynert*, and after him *Lubimof*, have already called attention to processes in the brain, in which likewise the appearance of network points as a symptom to some inflammatory process. *Spina* has also called attention, in the "*Medecin. Jahrbüchern*" for 1875, to analogous pictures in inflamed tendons, and this author will perhaps have occasion to pronounce still farther upon the subject.

What I have hitherto said of suppuration refers only to what may be called a bird's-eye view of lamellar preparations. But what is the condition of things in the deeper layers of the cornea? Information on this point can, of course, only be gained from transverse sections. The results gained from this source did not turn out as I had expected from the conceptions which I had formed concerning the structure of the cornea. I had conceived that the cellular network of the cornea extended in the deeper layers in the same manner as we have seen it do upon the surface; and that it would, as a rule, be found that there are processes which perforate the lamellæ anteriorly and posteriorly. I therefore formed the conception that such a nodule of pus would not be confined to the limits of a lamella. I was justified in this expectation, as I had measured the depth of the nodules and had found them considerably thicker than the neighboring parts which were not swollen. But on examining the sections, it was found that the swollen nodules had pushed aside the lamellæ, and were therefore thicker than the parts which were not swollen. In spite of repeated examination, however, I have not found a single spot where it could be said that a nodule extended through several lamellæ.

For the commencement of the process, therefore, and for the present, this stage is the only one to be considered, I must say that the inflammatory infiltration separates the lamellæ from each other, but does not immediately involve them as a whole; in other words, the lamellæ limit the extension of the beginning suppuration into the deeper layers of the cornea.

For the present I can give no information in regard to the con-

dition of affairs after disintegration has once taken place. I have already alluded in the introduction to the fact that I have here come upon certain conditions which are not yet completely intelligible to me, and their explanation must therefore be postponed to a future opportunity.

Finally, I must call attention to one circumstance. In places where nerve-fibres penetrate the swollen and divided corneal corpuscles, their contents appear to have undergone segmentation just like the branched cells. In Fig. 5 there is a representation of such a nerve-fibre, which, moreover, is quite swollen. If the pictures were not representations of corneal lamellæ, the reader might think that he had lymphatics or blood-vessels before him. But as these are excluded from possibility, because the preparations are of the cornea, I have only assumed my diagnosis as correct, when I could follow out the fibre until a point was reached where its contents was not filled with small elementary forms, but consisted of distinct nerve elements.

There was therefore no doubt that I had to do with nerves.

But, furthermore, there was no doubt that the elements which were seen within the sheath of the nerve were not inwandered ones. For these structures were situated in the nerve and within the region where the cells also were segmented; as soon as the nerve reached a field where the surrounding cells were unsegmented, it was seen to be traversed by the well-known brown oblong figures, by which normal nerves colored in silver are as a rule traversed. The small elementary forms, which are seen in the nerve of the suppurating region, must, therefore, have originated here.

Only two suppositions are here possible. Either the endothelium has here swelled and become segmented, or the axis-cylinders have become segmented, or else the two conditions exist together.

I have as yet no reason for excluding either of these views.

At this moment, when the lithographic plate accompanying these illustrations has just been finished, I have come into the possession of a preparation, in which the segmentation of a nerve-fibre is visible, which must be regarded as one without medulla, and the visible lines of limitation between the segmentations penetrate so undeniably through the entire thickness, that I cannot doubt that the axis-cylinder is here involved.

Whether, however, in thicker fibres the endothelium is or is not involved in the process, I cannot determine. I have already seen that the nerve-fibres without medulla swell up like cells when in foci of inflammation, and a statement to this effect has already been made by *S. H. Chapman*.* I must also abide by my assertion, that all the living constituents of an inflammatory focus may take part in the proliferation. The axis-cylinder certainly belongs to the living constituents. I therefore see no reason for putting any constraint upon the facts, nor for explaining in any but the simplest way the segmentation of the non-medullary nerve-fibres, which I have described.

I know very well that the axis-cylinder is not a cell. But the contractile substance of the transversely striated muscular tissue does not bear the character of a cell, and yet there is no doubt that a new formation may be developed from this substance, as has been established not only for the inflammatory, but also for other varieties of neoplasms.

* *Med. Jahrbücher*, 1873.

ON THE OPERATIONS FOR TRAUMATIC COLOBOMATA OF THE EYELIDS.

By H. KNAPP.

(With 3 Woodcuts.)

TRAUMATIC colobomata of the lids are not very rare. The operative procedures for their cure differ according to the seat, the extent (degree), and the complications of the colobomata. Without entering into a discussion on the various conditions this affection may present, I will here mention only one principle which guided me in all these operations, namely, *in the first place carefully to remove all cicatricial tissue*. If this is omitted, the patient is exposed to the danger of an almost certain relapse. In removing the cicatrix, we must have regard to two complications mostly met with in colobomata of the lids, *i.e.*, 1, a certain degree of a partial or total ectropium; and 2, the hypertrophic swelling of the conjunctiva resulting from the prolonged eversion of the lids. Not infrequently a more or less pronounced lateral displacement of the lid is present in these cases as a third complication, which, however, commonly disappears as soon as the cicatrix is completely excised.

The operative procedure best calculated to remedy the difficulty under consideration mainly depends on the location and extent of the loss of substance caused by the removal of the cicatrix and the hypertrophic portion of the conjunctiva. If the defect be small and triangular, and the surrounding tissue extensible, it will suffice, in most cases, to unite the wound by simple or twisted sutures. If the defect be larger, undermining of the adjacent skin will materially relieve the tension and secure the union. If the defect be extensive, a plastic operation can hardly be avoided, and I would, above others, recommend, in such cases, the method of forming lateral flaps, which I described, about ten years ago, in Graefe's Archives, and have since repeatedly practised with good results. This method, the principle of which has long

been well known, seems to have been cultivated particularly by French surgeons, for in a French book I found it designated as "*Méthode par glissement des lambeaux, ou méthode française.*"

In moderately large defects a method did me excellent service which stands midway between the simple union and the blepharoplasty by lateral flaps. This method may be briefly described as follows: Besides the careful union of the coloboma, the outer commissure is divided, and the adjacent skin, towards the temple, either above or below the outer canthus, according to the seat of the coloboma, is detached from its base to the extent of half an inch or more. Though no regular quadrangular flap, as in the sliding method, be formed, the outer portion of the lid is drawn toward the nose, and thus the shortening of the palpebral fissure is obviated. A part of the surface of the wound in the outer corner may be covered by stitching the conjunctiva and skin together, as is done in canthoplasty. Stitching the whole wound in the commissure would lead to lengthening of the palpebral fissure. For the details of the operation I refer the reader to the following case, to which the method was particularly adapted.

Jos. F., of Werschau, Nassau, Prussia, was hurt on Nov. 16th, 1874, by a full bottle thrown on the right half of his face and breaking into a multitude of fine pieces, which, like grains of salt, partly remained on his face, partly fell to the ground. The skin of the forehead and cheek was cut down to the bone; on the upper lip the wound penetrated through the skin and the gums, and several teeth had become loose. A gaping corneal wound was in the eyeball, and the lower lid was split from the centre of its free edge down and inward. He was confined to his bed, and made cold applications for five weeks, but there were no cerebral symptoms. The wound in the eyelid was closed with sutures by Dr. Ulrich of Dauborn. The patient consulted me in July, 1875. He looked well, strong, and plethoric. Concerning his character, his friends testified unanimously that he liked spirituous liquors of every description, and since the time he received the injury had been addicted to idleness and drinking. His hostess informed me that he was accustomed to take about twenty glasses of beer a day, and a glass of whiskey every now and then between the beer. He told me that he had a hollow molar tooth which bled once or twice every day. A large cicatrix was on his forehead, another on his cheek, which went through the whole thickness of his upper lip. The shape and motion of the upper eyelid were normal.

The globe had the usual size and consistence. The lower two thirds of the cornea were diffusely opaque, and an irregular vertical adherent cicatrix passed through the whole cornea. In the upper-inner part a remnant of clear cornea and anterior chamber was preserved, through which the iris was visible. Perception of light being present, an artificial pupil at this point was not without a tolerably good chance of restoring a moderate degree of useful vision. The centre of the lower lid (four lines in length) was everted and drawn down by a dense cutaneous scar passing in a curved line down and inward. Opposite the cutaneous scar there was a roundish, ungainly intumescence of hypertrophied conjunctiva (Fig. 1, *w*). The lids could not be closed on account of this scar and conjunctival intumescence, and the patient suffered from epiphora and catarrhal conjunctival dischargé.

With the kind assistance of Dr. *Hess* I operated on the patient in the following way: With a strong pair of strabismus scissors I excised the whole scar and hypertrophied portion of conjunctiva. This occasioned a considerable loss of substance (Fig. 2), leaving hardly four lines of eyelid on each side. The skin on both sides (*a* and *b*, Fig. 2) was undermined

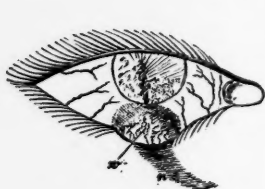


Fig. 1.

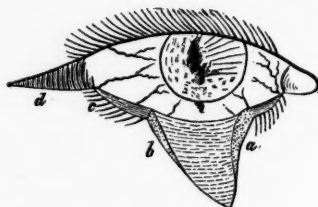


Fig. 2.

with a pair of scissors; but when I tried to unite the flaps there still was marked tension. I therefore slit the outer commissure and undermined the outer part of the lower lid and the skin under the wound in the outer commissure (*c*, *d*, Fig. 2) to the extent of half to three quarters of an inch. The division of tough ligamentous bands, which gave a perceptible resistance to the scissors, rendered the outer flap so movable that now the union of the preserved lateral parts of the lids could be easily accomplished, and there was no longer any tension. I used five simple sutures, the highest of which was close to the edge of the lid (see Fig. 3). In addition to this, I united the conjunctiva with the skin at the inner-lower part of the wound in the commissure by two sutures (see Fig. 3). There was no notch in the edge of the lid; the whole lower lid was

properly applied to the globe, and the lids could be easily closed and opened. The whole lower lid had preserved its natural color, even the edges of the previous coloboma showed no blue discoloration. Both eyes were closed with the usual charpie-flannel bandage, the charpie of the eye operated on having previously been greased by a thin layer of cold cream.

There had been very little loss of blood during the operation. The

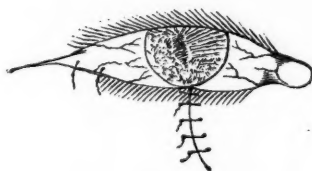


Fig. 3.

sutures having been applied after the bleeding had carefully been arrested, caused no new hemorrhage.

Patient had a good night. On changing the dressing I found the whole wound beautifully united, no secretion of the conjunctiva, and no oedema of the lids. Both eyes were kept closed as before; fluid or soft food, excluding liquors, ordered, and he was forbidden to leave his bed.

The *third* day after the operation he was in a satisfactory condition.

On the *fourth* day I removed the two sutures at the outer canthus, and three sutures from the wound in the lid, leaving the upper and the middle one. The wound was perfectly closed, and there was no notch at its upper end. Both eyes were kept bandaged, and the patient particularly cautioned to stay quietly in bed, since, after the removal of the sutures, the least stretching of the lid might break the fresh and weak union of the wound. But on visiting him unexpectedly in the afternoon, I was surprised to find him sitting in the most comfortable *négligé* behind an open window, the bandage of the healthy eye shifted up over his brow, a pipe in his mouth, a novel in his hand, and an empty beer pitcher at his side. He looked an enviable picture of contentedness with his own self and surroundings. That this happy situation was rudely brought to an untimely end by my unexpected interference, I hardly need mention. On removing the bandage I found a slight separation in the *lower* part of the wound. When he held his eyes open he would wink obstinately, briskly, and almost incessantly, by which, of course, he pulled persistently and efficiently at the young scar. I therefore bandaged both eyes again, and

gave him strict injunctions not to touch the bandage any more, and lie quietly in bed on his back.

In the morning of the *fifth* day the lower part of the wound had reunited, and the lid showed no irritation. I removed the last two sutures, which was done without bleeding or rupture of the wound. No supuration had taken place in the stitch canals. Both eyes were bandaged again, and the patient was warned to abstain from all movements of his eyelids, since after the removal of all the sutures the wound had no protection left against tearing of any kind. In the afternoon I was called: "the eye bled." I found the bandage and lint saturated with fresh blood, which, however, had ceased running. The whole wound was still united, yet the interposed new cicatricial tissue was distended. I therefore supposed that on the conjunctival surface a portion of the scar had given way, causing the hemorrhage.

On the *sixth* day the eyelid looked excellently well. The wound appeared firmly united in its whole extent. For the sake of precaution, both eyes were again bandaged, and the patient was requested to remain in bed another day. At three o'clock at night I was called: "the eye was profusely bleeding." I at once hastened to the patient, and saw bright red blood freely running down the cheek. After removal of the dressing I found the whole wound still united, and blood welling up between the lid and the eyeball, consequently from the inner surface of the wound. I applied cold wet compresses to the eye for about a quarter of an hour, but to no effect. Not being allowed to turn the eyelid and put styptic remedies on the bleeding surface itself, I applied a pressure-bandage consisting of several thicker wet compresses, which were pressed against the closed eyelids by a threefold turn of an elastic flannel bandage. Some blood still oozing out, I placed another thick wet compress upon the first dressing, and increased the pressure by a second rather tight flannel bandage. This completely arrested the bleeding without causing any pain. This dressing remained untouched until the evening, when I carefully removed it. The bleeding had not returned, the lid was not swollen, but at its edge the wound was separated about a tenth of an inch. I padded the eye with picked lint, placed a compress on the lint, and fastened it with a flannel roller.

In the morning of the *eighth* day a slight bleeding had again taken place, which, however, soon stopped. The wound was as the day before. Dressing the same. The *ninth* day all irritation had disappeared. On the *tenth* day, no further bleeding having occurred, the patient was discharged, with the understanding to have the small notch in the lid removed by a second operation, if it should prove worth the

trouble. He presented himself again a week afterward ; the notch was almost closed, there was no swelling of the lid, no lachrymation, and the position and movements of the lid were normal.

Since colobomata are very often left after injuries of the eyelids, especially the lower, the treatment of those injuries should be particularly directed toward their prevention. The main cause of these colobomata lies in the action of the m. orbicularis palpebrarum, as is well known, and could be beautifully demonstrated in the case just reported. The mechanism, briefly stated, is the following: When the orbicular muscle of the eyelids, the fixed points of which are the ligamenta canthi internum et externum, contracts, the shortening of the muscular arcs raises the the lower lid and depresses the upper until the free edges of the lids form a part of a greatest circle track, which is the shortest cut between their end-points. When these muscular arcs are divided, the parts contract in such a way as to move the edges of the wound toward the ligaments. *To counterbalance this muscular action is the problem and secret of the successful treatment of the injuries of the eyelids.* Adapting the methods of operation to the condition and degree of the affection, we have, to obtain our aim, the following means at our disposal :

1. *Careful union of the wound by simple or twisted sutures, or both combined.* I use in these and similar (plastic) operations almost exclusively simple sutures of fine Chinese bead-silk. They are applied with delicate curved needles by means of a Sands' or similar needleholder at no greater distance from one another than one or two-tenths of an inch. In this manner the coaptation of the edges of the wound is as close as it can be made, the contusion of tissue from the piercing needles is very slight, the calibre of the stitch-canals and the foreign bodies lying in them is minimal, and the traction from muscles and other elastic tissue is more uniformly distributed over the whole wound, that is, divided among a greater number of fixed points than when coarser material is used for sewing, which, it is true, necessitates fewer sutures, but they must be drawn tighter. Many fine sutures, if I am not mistaken, produce suppuration not so readily than few larger sutures. A very exact union of the wound, such as can be effected only by delicate sutures, which are close together, is of

particular importance on the free edge of the lid. A fine suture has to be applied, under all conditions, to the intermarginal part, or to its nearest vicinity. In addition to simple sutures, one or more twisted sutures might be employed. As a rule, I avoid, in operations on the lids, twisted sutures, as well as coarser buttoned sutures, for both, by passing through a larger extent of tissue, and being drawn more tightly, favor the eversion of the free palpebral edge by which just that part is stretched, the union of which is not only most important, but most difficult. On account of its manageableness, I prefer silk thread to silver wire, which is so celebrated by my gynæcological friends, and appreciate its advantages for the peculiar and easy way by which the tying is done in cavities difficult of access.

2. *Closure of both eyes.* I prefer for this purpose the usual charpie-flannel bandage, because it secures better than others the immobility of the lids, provided the corners of the eye be well padded. The closure of both lids has to be continued uninterrupted until a rupture of the wound is no longer to be feared, that is, in some cases, five or six days. Closure of one eye (the diseased) does not protect it from the incessant motions which its lids perform under the bandage in association with the motions of the lids of the other (healthy) eye left open.

In the great majority of the cases of traumatic coloboma these two means, careful union of the wound by sutures, and closure of both eyes, will be found sufficient to effect a cure. If, however, the wound be large, and the patient so uncontrollable as in the case above described, further expedients have to be sought. These are:

3. *Supporting sutures.* Chinese bead-silk, I think, is the most appropriate material also for these sutures. In the lower lid the needle pierces the tarsal cartilage from the skin toward the conjunctiva at a distance of 2'''-3''' from the wound; the thread then passes along the conjunctiva to a point 2'''-3''' on the other side of the wound, then again pierces the lid, this time from the conjunctiva toward the skin, and is tied on the outer side of the lid. The cornea always being raised when the eye is closed, the highest suture may be applied near the free edge of the lid without irritating the cornea. On the upper lid I would apply the support-sutures in the following way: The needle, about 2'''-3''' distant

from the wound, and $1\frac{1}{2}$ " above the free palpebral border, penetrates through skin and muscle into the substance of the fibro-cartilage, passes straight down through the cartilage, and emerges on the skin near the insertion of the cilia. The thread then is carried over the skin, just above the eyelashes, to a point situated about as far from the other wound as the point of insertion was on this side; there the needle penetrates again through skin and muscle into the cartilage, passes straight upward in its substance, and emerges about $1\frac{1}{2}$ " above the free edge of the lid. The ends of the thread are then united on the skin. The thread nowhere comes in contact with the eyeball. One supporting suture for each lid will, I think, be sufficient in the majority of cases that require supporting sutures at all. When placed in the vicinity of the free edge of the lid, it counterbalances most efficiently the action of the orbicular muscle tending to separate the wound. If the wound in the lid be long, and considerable tension of the skin be present after its union, another supporting suture may be applied at a greater distance from the free palpebral edge. Care, however, has to be taken that the sutures, in particular the lower one of the lower lid, are not too tightly drawn, lest ectropium ensue, with its unpleasant consequences.

Supporting strips of adhesive plaster, drawing the skin from both sides toward the wound, may well be applied; but on account of the uneven surface of the vicinity of the eyes, their efficiency is less in this locality than in most others. On the whole we must not expect a great deal from their efficacy.

4. *Relaxing incisions*. There is no obstacle in the way of dividing, on one or both sides of the wound, the skin and muscle by vertical incisions down to the cartilage, respectively the orbito-palpebral fascia. Such incisions gape considerably at first, and therefore must relax the tension most effectively; but later they very kindly heal, leaving a scar hardly visible, and occasion no change in the position and movements of the lids.

In the above case I obtained, in a different way, the relaxation of the skin and the temporary suspension of the action of the orbicular muscle on one side—the temporal—of the wound, namely, by slitting the outer commissure and detaching the skin below it from the temporo-buccal fascia. The nasal side of the wound had been left untouched. The consequence of this condition was that

every motion of the lids drew the lower lid toward the nose, thus exerting a constant, though one-sided pull at the wound. These motions were extraordinarily extensive in our patient, who was in the habit of constantly and forcibly winking. In his case a vertical incision, near the lachrymal point and on the temporal side of it, would have been indicated.

Another method of temporarily and almost completely paralyzing the tension of the skin, and the traction of the muscle toward the nose, a method which I would recommend in high degrees of palpebral coloboma, and certain plastic operations on the lids, is the following: That portion of the lid which lies below the inner commissure is detached with a pair of strabismus scissors from its base, in such a way that, from the conjunctival sac toward the cheek and nose, all the muscular fibres, except the highest bundle around the canaliculus, are severed without implicating the lachrymal sac and the canaliculus, nor dividing the inner commissure. Neither the cartilage, which in this locality is only 1" in breadth, nor the skin need be injured, though an accidental perforation—fenestration—of the skin does no harm. The fixation and nutrition of the lid are effected by the skin and the tissue surrounding the canaliculus. The mode of loosening just described renders the inner part of the lid very extensible, without endangering its integrity of substance and position. The injury is less extensive than with the method of blepharoplasty by lateral flaps, which, on its part, when restricted to its proper limits, *i.e.*, to defects not exceeding two-thirds of the lids, reckoned from the lachrymal point to the outer commissure, does not expose the flaps to the danger of sloughing.

The different operative procedures which I have here described seem calculated, either one alone, or some in combination, according to the condition of the case, to supply all palpebral defects that do not exceed one-third, or even two-fifths, of the edge of the lid. A maximum effect is obtained if the outer commissure is divided; further, the lid and adjacent skin near both commissures are, with a pair of strabismus scissors, undermined and detached from their base, the wound is united by simple sutures placed close together, one or two supporting sutures are added, and both eyes kept shut by a charpie-flannel bandage as long as there is danger of separation of the wound.

These methods, as well as the formation of lateral flaps, have the advantage over others of obviating ectropium, ungainly swelling or extensive sloughing of the flaps. The worst accident I have met with in these operations is the separation of the upper end of the vertical line of union. This is of less importance than it seems at first to be, for the partially open wound, provided no old cicatrix be present, unites later in an unexpected manner, similar to the ultimate reunion of divided commissures. If a notch is left, it can readily be closed by a simple secondary operation.

ANTHRAX ON THE INNER SIDE OF THE LOWER EYELID.

By H. KNAPP.

ON Jan. 8th, 1874, a strong healthy-looking boy was brought to me with an affection of his right lower eyelid which I had never seen before.

The parents had first noticed, five days previously, some redness on the lower part of the eyeball. The next day the lower lid was swollen. In the morning of the third day the lids were baked together by dried mucus. When the eye was cleansed a uniformly red hemispherical swelling was observed in the centre of the everted lower lid. On the fourth day this swelling had increased, and its centre appeared yellowish, as if containing matter. When I saw him, on the fifth day of the disease, there was in the centre of his everted lower eyelid a round elevation of 2''' in diameter, with a depressed exulcerated crest, resembling the mouth of a boil or small evacuated abscess. The whole inner side of the lower lid was red, swollen, and studded with ten or twelve roundish little tumors, the centres of which were semi-transparent, whereas their periphery was deep-red. These little tumors, which had some resemblance to the spawn-like granules of follicular trachoma, were grouped together in a cluster which extended from the lachrymal point almost to the outer commissure, and was raised about 1'''—1½''' over the level of the conjunctiva. The lid was swollen, tender to the touch, but hardly painful of itself. Some sero-mucous secretion was present. The eyeball was normal. A swollen gland was in front of the tragus. No fever. I ordered warm-water applications an hour during the day.

The next day the lid was more swollen, its outer surface shining red, the region of the lachrymal sac and the edge of the upper lid were œdematous, some glands before and below the ear were swollen and painful. The patient was feverish. The conjunctiva was chemotic, the inner side of the lower lid more swollen, hard, and painful to the touch; the small, roundish elevations were partly concealed in the deep purple of the general swelling. Eyeball unaffected. Fearing that extensive sloughing

was imminent, I made two deep incisions through the hard and swollen part of the inner side of the lower lid, parallel to the ciliary edge. The sections revealed a hard, dense, deep-red tissue, in which six to eight white, tough plugs were embedded. They adhered so firmly to the surrounding tissue that they could not be pressed out, and were torn when seized with the forceps. The resemblance of the disease to a carbuncle of the outer integument could not be greater. I ordered poultices for two or three hours in succession.

The next day the symptoms were essentially the same. I made another deep incision, which showed the white plugs more pronounced and better defined than on the two preceding incisions. Poulticing continued. The day after, the swelling of the lids and conjunctiva had diminished. The glands near the ear were still swollen and tender. On the inner surface of the lower lid were a number of points of suppuration, some of which on pressure discharged thick pus. Poulticing continued. The day after, all the symptoms had improved. On the inner face of the lower lid appeared numerous points of pus—the heads of small boils. During the following days, under continued poulticing, the mouths of the small furuncles were converted into clean ulcers which rapidly closed. The glands near the ear and the swelling of the lid disappeared. The inner surface of the lower eyelid became smooth again, and after a month showed hardly any trace of the previous difficulty. On inquiring after the boy the other day, *i.e.*, twenty-two months after the disease, I learned that he has continued in good health, and his formerly diseased eye has been as well as the other.

The foregoing description represents, it seems to me, a strange and exceptional affection—a carbuncle or anthrax on the inner side of the lower eyelid. It began with a furuncle, situated in the centre of the reflection fold, that is, about midway between the free edge of the lid and the reflection of the conjunctiva to the globe. During its progress it was surrounded by a dozen or more other furuncles, which were grouped together in a cluster, producing a hard, painful, uneven intumescence the size of a large French bean, of purple color and oval shape, with its longest diameter parallel to the free edge of the lid in the papillary body of the conjunctiva, the same region in which the greatest development of trachoma granules takes place. I have several times met with carbuncles in the skin of the upper lid, principally in the brow and its neighborhood. One of them caused a con-

siderable destruction of the skin and subcutaneous tissue at the upper-inner corner of the orbit, though I had made deep and early incisions. The skin of the superciliary region being dense, the development of anthrax in that locality is not surprising, but to see carbuncles originate in the loose connective tissue on the inner side of the lower lid is certainly peculiar.

As to the *cause* of the difficulty I could get no information. Carbuncles in general are very infrequent in children, and this boy had not exposed himself to any infection.

Although I never met with exactly the same disease which is above described, I have seen conditions more or less similar to it. I have repeatedly seen small, isolated abscesses or furuncles in the conjunctiva of the lids, and even small abscesses in the conjunctiva of the sclerotic. They offered no extraordinary features. The above case seems to have begun as a simple furuncle, which by the aggregation of a number of others assumed the nature of a carbuncle. That such a succession is so rare seems to be owing to the looseness of the tissue in which the original boil takes root, giving little occasion to dense infiltration, compression, and sloughing of the parts. A few times, however, have I observed, in young persons, a condition which may have been a consequence of anthrax of the palpebral conjunctiva. The inner surface of the upper or the lower lid was the seat of hardish, diffuse, and nodular intumescences, a part of which were ulcerating, showing depressed centre and raised borders, the bottom of the ulcers being covered with pus. These swellings were distinct from papillomatous, cauliflower growths, from which even children are not exempt. They had some resemblance to exuberant trachomatous infiltrations, a part which, on account of their rapid increase, *decayed*, giving rise to polypoid or fungoid excrescences, while the other part lay as semi-transparent or reddish nodules embedded in the conjunctiva. Their course was more protracted than in the case above described, their treatment having been either expectant or consisted in the employment of astringent collyria. The swelling and destruction of tissue was more or less extensive, but all the cases perfectly recovered under the use of careful cleansing, and the application of sulphate of copper in substance, and nitrate of silver in solution. The occurrence of this disease in only one eyelid makes it now appear probable to me that in the former

cases also I had to deal with the sequels of carbunculous rather than trachomatous affections.

From the foregoing remarks it seems to be evident that the *prognosis* of anthrax of the inner surface of the eyelids is favorable.

As to *treatment*, cold applications may be tried at the very beginning, but I believe that early and deep incisions, as in carbuncles of the skin, are of the greatest importance. In addition, I would recommend warm-water applications or poulticing, and in the last stage, if necessary, the employment of astringent collyria.

DETACHMENT OF THE RETINA CAUSED BY THE MEDICINAL USE OF WHISKEY.

By H. KNAPP.

THE use of strong drink as an occasional cause of detachment of the retina is not mentioned in the standard text-books of ophthalmology so far as I have examined. A remarkable instance of it, however, came under my observation in December, 1868.

A man, E. K., of Stapleton, Staten Island, N. Y., æt. 64, of robust constitution and quiet deportment, consulted me on account of sudden failure of sight in his left eye. He stated that his father and several members of his family had been near-sighted, but otherwise always enjoyed good vision. He himself had been myopic from his early youth, his right eye, however, had been good until six weeks previously. At that time he suffered from diarrhœa, for which, after it had persisted unabated for four days, he took a glass of strong whiskey. Immediately afterwards he noticed the most unpleasant sensations of light and fire before his eyes, the sight of his left eye became more and more impaired, and when he shut his right eye, a black curtain completely covered everything above him, while all the objects in front and on the floor were shrouded in a dense mist. His diarrhœa ceased at once, and did not reappear, but the condition of his eye did not improve; on the contrary the black curtain extended farther downward. He stated that he had never been addicted to stimulants of any kind, but that of late years he had had several attacks of diarrhœa, which he had always arrested by taking a glass of strong whiskey, not so much, however, as to get drunk. Each time when he did so, he saw flashes of light and fiery sparks before his eyes, which annoyed him for hours, and then disappeared without injuring his sight. When I saw him he had the appearance of a temperate man, and upon further inquiry I had no reason to doubt his statement. His right eye showed M. $\frac{1}{10}$, a large crescent, but no other abnormality in the

inner coats nor any opacity in the media. He read I. 1 fluently. The media of his left eye were turbid, the optic disc and the details in the upper half of the fundus could be dimly seen. The retina of that portion was in its normal position, whereas the whole lower half was detached. In the upper half of the visual field there was no perception of light, and the vision in the lower half was greatly reduced.

Since the retina was detached in the form of a large floating bladder, and this condition had existed for six weeks, I ordered nothing but inunctions of mercurial ointment to the forehead and left temple, and recommended him to avoid all excesses in his diet and occupation, lest his other eye should become similarly affected. I saw him but once more. No change had taken place in the condition of his eyes.

Though in the prophylactic treatment of progressive near-sightedness or advanced posterior staphyloma, we never fail to caution our patients against the abuse of stimulants, the above case is a striking example that in this affection even a single large dose of alcoholic liquor may lead to disastrous consequences.

A CASE OF PRIMARY SARCOMA OF THE IRIS, CURED BY EXCISION OF THE TUMOR.

BY CHARLES J. KIPP, M.D., OF NEWARK, N. J.

(With Plate VIII.)

WILLIAM COATES, æt. 36, a well-built, robust man, residing at 73 Boyden Street, Newark, N. J., presented himself at St. Michael's Eye and Ear Infirmary, Newark, on account of loss of sight in his right eye. He states that he has always enjoyed excellent health, that he has never had syphilis, and that neither of his eyes has ever received any injury. With the exception of his father, who has a large epithelioma of the lower lid of his right eye, no member of his family has been or is now suffering from disease of the eyes or from tumors of any kind. Twelve years ago he first noticed a reddish nodule, of about the size of a pin's head, near the lower pupillary margin of the iris of the right eye, but as it gave him no pain he paid no further attention to it. The growth of this tumor was exceedingly slow till about a month ago; since that time it has, however, grown more than in the preceding twelve years. During the last few weeks he has also noticed a gradual failure of sight, and has occasionally suffered from pain in his right eye.

Present condition.—The left eye presents no abnormality. S. $\frac{2}{3}$ 0. Right eye: The lids and surrounding structures are normal. The mobility of the globe is unimpaired. The conjunctiva and the episcleral tissue are in a healthy condition, and the cornea is perfectly transparent. The anterior chamber is of normal dimensions, and partly filled by a growth (Tab. viii., Fig. 1) of a flesh color, apparently measuring 7 mm. in height, a little more than 5 mm. in breadth, and about 4 mm. in thickness in its upper portion. The tumor appears to be attached to the inner lower quadrant of the iris by a broad base, extending from the pupillary margin to about $1\frac{1}{2}$ mm. from the ciliary margin of the membrane, and projects forwards, upwards, and outwards into the anterior chamber. With the exception of a slit-like space in its upper portion, the pupil is covered by the growth. The lower half of this tumor is of a uniform pinkish color, its anterior surface is slightly covered and perfectly smooth, whilst the

upper half is slightly nodular, of a somewhat lighter color, and studded with numerous minute dark-red points, which, looked at with a magnifying glass, appear to be small extravasations of blood. The upper portion of the tumor is somewhat thicker than the lower, and is in contact with the posterior surface of the cornea, and also, apparently, with the anterior surface of the lens capsule.

The aqueous humor is clear. The iris is in its normal plane, and when it is not covered by the tumor it is normal in color and structure. The upper half of the iris responds readily to the action of atropine. There are no posterior synechiæ visible. After dilatation of the upper part of the pupil, the lens and the vitreous humor are found to be perfectly transparent, and the optic disk, retina, and choroid present the same healthy appearance as in the left eye. The eye is emmetropic. S. $\frac{2}{3}$ after dilatation of pupil. The tension of the eye is normal.

Pain in and around the eye, and lachrymation on exposure to light are the only symptoms of which he complains. His health is excellent.

Believing the tumor to be a primary sarcoma of the iris, which had not as yet given rise to secondary foci, and being convinced of the practicability of removing the growth, with that part of the iris to which it appeared attached, through a large section in the lower sclero-corneal margin, I advised the patient to submit to the operation without delay. After considerable hesitation his consent was given, and the operation performed on the 12th of December, 1873, in the presence of several medical gentlemen, including Dr. H. Knapp, to whom I am especially indebted for advice and assistance in the operation.

Operation.—The patient being under the influence of ether, the point of a very narrow Graefe's cataract knife, with its cutting edge directed downwards and forwards, was entered at the lower sclero-corneal margin, 2 mm. outwards of the vertical meridian, passed through the lowest portion of the anterior chamber, the back of the knife hugging the lower boundary of the tumor, to a point at the inner sclero-corneal junction about 4 mm. below the horizontal meridian, and the section completed by pushing the knife onward. The section thus made being apparently too small to permit the easy delivery of the tumor, the incision was enlarged for about 3 mm. at the inner angle, with a strong pair of scissors. The iris did not prolapse. A pair of iris forceps, with their blades widely open, were now passed into the anterior chamber, as far up as the lower pupillary margin, and a large fold of the iris grasped on both sides of the base of the tumor. Slight traction sufficed to draw both iris and tumor out of the chamber. The operation was completed by cutting off the protruding portion of the iris close to its ciliary margin.

The subsequent treatment consisted in the application of the protective bandage and instillation of a solution of atropine.

On the following day the wound was closed and the anterior chamber restored. Two days later a very slight iritis manifested itself, and continued for about a week, without, however, causing any posterior synechiae. On the thirteenth day all symptoms of irritation had disappeared, and on examination the sight of this eye was found to be equal to that of his left (S. $\frac{2}{3}$).

The patient was last seen about eighteen months after the operation, at which time the eye was entirely free from disease, and his general health was unimpaired.

The microscopic examination was made after the tumor had been sufficiently hardened in Mueller's fluid. The tumor consisted principally of beautiful, white, spindle-shaped cells, with long thin processes, and of some free oval nuclei. The spindle-shaped cells were finely granular, had each a distinct oval nucleus and a round nucleolus (Fig. 3, Tab. viii.*), and were closely packed in groups, with their long axes directed nearly parallel to each other (Fig. 2, Tab. viii.). The free oval nuclei, which had also each a shining nucleolus, were embedded in a scanty homogeneous matrix, and were found exclusively at the periphery of the base of the tumor.

The tumor contained a considerable number of blood-vessels (Figs. 2 and 3, *v*), some of which were quite large. Their walls consisted of a single homogeneous transparent layer. Pigment was present only in limited quantities. It was found mainly at the base of the tumor in free granules (Figs. 2 and 3, *g*), in groups of disks (Figs. 2 and 3, *d*) and in irregular masses (Fig. 2, *p*).

Sections through the base of the tumor showed the neoplasm to be in immediate connection with the pigment layer of the iris (Fig. 2, *u*), except at the outer, lower and inner periphery, where a thin layer of apparently healthy iris stroma intervened between the tumor and the uvea.

The portions of the iris removed with the tumor were normal.

From the above description it will be seen that the tumor under consideration was a true, white, spindle-celled sarcoma. Its

* This drawing was made from a section mounted in Canada Balsam, and does not show the details plainly.

starting-point was in all probability the stroma of the iris. With regard to the causes which produced the growth, nothing is known; the eye had never received an injury, and there was no evidence of sarcomatous disease in any other part of the body.

Cases of sarcoma of the iris are so very rarely seen that it may not be uninteresting to refer briefly to the cases already on record. The first of these occurred in the practice of *von Graefe*, in 1868, and was published by *Hirschberg* in the *Archiv f. Ophthalmologie*, Bd. XIV. Abtheilung 3, p. 285. The patient was a man 38 years of age. The tumor, which had developed in the course of a year from a congenital pigment spot in the lower half of the iris, was of a dark-brown color, and nearly filled the lower two-thirds of the anterior chamber. Central and eccentric vision were unimpaired. *Von Graefe* made the diagnosis of malignant growth of the iris, and enucleated the eye. The patient was last seen five months after the operation, at which time there were no signs of a relapse in the orbit, and his general health was good. The microscopical examination made by *Hirschberg* proved the tumor to be a pigmented spindle-celled sarcoma, which had probably developed from the middle layer of the iris. With the exception of the lower half of the iris, from which the tumor grew, all parts of the eye had preserved their integrity.

The second case of this disease on record was published in the early part of 1874, in these Archives (Vol. III., Part 2, page 106), by *Drs. A. Robertson*, of Edinburgh, and *H. Knapp*, of New York.

The patient, a healthy-looking woman, 24 years of age, was admitted under Dr. Robertson's care in the ophthalmic wards of the Royal Infirmary, Edinburgh, on June 29, 1871. Fourteen months before that time she had had a slight painless inflammation in the right eye, of short duration. Six months later she had occasional attacks of severe pain in right eyebrow and temple. Two months after this she accidentally discovered that the sight of the right eye was greatly impaired. On admission the *left* eye was found to be normal. In the *right* eye the pupil was larger than in the left, and immovable. In the upper and outer part of the iris, and at its junction with the ciliary ligament, was an oval, brownish tumor measuring $1\frac{3}{4}$ " in length by 1" in breadth, and extending downwards from this tumor, keeping to

the ciliary margin of the iris, there was a chain of three other similar tumors about $\frac{1}{2}$ " in diameter. The patient could hardly distinguish bright light from darkness. T. + 2. With the exception of a deep glaucomatous excavation of the disk, the fundus presented nothing abnormal. Dr. Robertson viewed the case as one of melanotic sarcoma of the iris, and enucleated the eye on July 4, 1871. Two years after the operation there were no signs of a return of the disease. The eye was examined by Dr. Knapp, who found all the coats of the eye, except the iris, in a healthy condition. The posterior and middle layers of the iris were unchanged, but the anterior layer was thickened and studded with small oblong and round tumors. Sections through the larger tumors disclosed a uniform, cellular, extremely vascular texture in immediate contact with the pigment stratum. The structure of all the tumors consisted of densely crowded, small, round, and oval cells, or nuclei, surrounded by scant protoplasm, embedded in a homogeneous matrix. The pigment, which was very scant in the smaller nodules, but conspicuous in some parts of the larger tumors, was found in isolated granules, in clusters of small disks, and in round and irregular forms.

The third case on record is described in the *London Lancet*, of January 16, 1875, page 82, by Dr. F. Dreschfeld, of Manchester, England. The patient, a woman, aged 53, was under the care of Dr. David Little. The tumor had developed in the course of about two years and a half, and its growth had been attended by repeated hemorrhages into the anterior chamber. It was of a reddish-gray color, about the size of a split pea, and was situated in the lower half of the iris of the left eye. As the eye was painful, its sight impaired, and the intra-ocular tension increased (T. + 2), Dr. Little enucleated the eyeball in the latter part of July, 1874. Of the subsequent history of the case no mention is made in the report. The anatomical examination showed the exterior parts of the eye to be normal. On making a vertical section of the eye, the mass filling the lower half of the anterior chamber was found to be a small tumor, in section whitish, soft, and granular. It was bounded anteriorly by the cornea, to which it was firmly attached; posteriorly to the pigment layer, which it had left intact; inferiorly by the ligamentum pectinatum, which appeared also quite normal; the superior boundary of the tumor

was free. The ciliary body below was pushed back a little, and with it the lens, the anterior and lower part of which was opaque. The upper half of the iris and all the other parts of the eye were normal. Thin sections at different regions of the tumor showed it to be composed of two parts. The one less transparent consisted of white spindle-shaped cells, with a large well-defined nucleus, and a highly refractive nucleolus. There was hardly any intercellular substance between them. The other more transparent portions, forming round or oblong islets, surrounded everywhere by the spindle-cells, from which, however, they were separated by a layer of pigment, proved to be cells of organic muscle. Besides these elements there were small blood-vessels and masses of pigment in all parts of the tumor. When the tumor had abutted against the cornea, the posterior epithelial layer of the cornea had disappeared, fat granules filled up the interior of the corneal corpuscles, and were also found free in the inter-lamellar spaces. Dr. Dreschfeld is of opinion that the tumor originated in the intermuscular tissue of the iris.

From the above it will be seen that the treatment pursued in all of the recorded cases, except my own, was that of enucleation of the eyeball. At the time I operated on my patient's eye I was not aware that a sarcomatous tumor of the iris had ever been excised, but since then I have learned from *Prof. Arlt's Operationslehre (Handbuch der Gesammten Augenheilkunde, redigirt von Prof. A. Graefe und Prof. Th. Saemisch, Band III., Cap. II., page 420, published in 1874)*, that he knows of two cases in which such tumors were removed by a procedure analogous to an iridectomy. No history or description of the cases is given, but it is stated that they were last seen five or six weeks after the operation, and that at that time there were no signs of a relapse.

A CASE OF VASCULAR PROTRUSION OF BOTH EYEBALLS, MOST PROBABLY FROM ARTERIO-VEINUS COMMUNICATION IN THE CAVERNOUS SINUS—TOTAL BLINDNESS—LIGATION OF THE LEFT COMMON CAROTID—RECOVERY.

BY DR. EMIL GRUENING, OF NEW YORK.

THE cases of vascular protrusion of the eyeball recorded in literature, and the statistics of operations upon the carotid for this disease, have been collected, tabulated, and analyzed by Dr. Th. G. Morton,* of Philadelphia, and Dr. Henry D. Noyes,† of New York. The work accomplished by these gentlemen is thorough, and it seems more appropriate to refer to their papers than to preface my case with a reproduction of their statistics.

I employ here the term "vascular protrusion," substituted by Mr. Nunneley for the less comprehensive and frequently misapplied term, "orbital aneurism." There is satisfactory post-mortem evidence that in cases of supposed orbital aneurism the affection may neither be orbital in site nor aneurismal in character.

Cases of vascular protrusion of the eyeball have been observed and described, in which the symptoms of orbital aneurism depended on an arterio-venous communication in the cavernous sinus. Such a communication I believe to have existed in my case.

In the vast majority of published cases of vascular protrusion from different causes the exophthalmos was limited to one side, in but a few instances both eyeballs were affected, and in some of the latter, *e.g.*, in that of VELPEAU, curious phenomena were noticed. Pressure on the right carotid stopped the pulsations of

* American Journ. of Med. Sciences, April, 1865, and July, 1870.

† New York Med. Journ., March, 1869.

the left eyeball, and pressure on the left carotid those of the right eyeball. Velpeau was very much puzzled by this phenomenon. In another case of double vascular protrusion, described by Dr. HARLAN,* of Philadelphia, only the right eyeball showed marked pulsations, which were controlled by compression of the carotid of the same side, and not at all influenced by pressure upon the left carotid.

My case is one of double protrusion of the eyeballs, and as a particularly interesting feature in connection with it, I may mention the immediate restoration of the totally abolished sight by ligation of the left common carotid artery.

The two cases cited, as well as my case, were of traumatic origin.

Mrs. Susan E. Canterbury, aged 59, a tall, weak, and slender woman, came to the Dispensary of the N. Y. Ophthalmic and Aural Institute, May 10, 1875, and gave the following history. In the evening of February 20, 1875, while descending a flight of stairs of a strange house, in the dark, she slipped and fell down four or five steps, striking her forehead violently against some hard object. The people of the house, roused by the fall, found her lying on the floor in an unconscious condition. They carried her into a room, and applied various restoratives. She recovered her consciousness in about two hours. Her head ached; her forehead, left temple and eye were bruised and sore. She rested but little that night, and early in the morning vomited some black and clotted substance, most probably blood. The headache continued, but she was able to walk to her home, a distance of six blocks. In the course of that day she bled profusely from her nose, the blood streaming from both nostrils. When the bleeding ceased, the headache had entirely subsided, and she felt comfortable for several hours. After that time the headache reappeared, and persisted many days, notwithstanding the repeated application of leeches to the temple, and the extraction of a tooth for the purpose of drawing more blood.

On the fourth or fifth day after the accident the patient noticed a faint noise in the head, which gradually increased in loudness, and could be likened to the working of a steam-engine. The constant noise rendered her very restless and deprived her of sleep. At about the same time she discovered that her left eye squinted towards the nose, moved less freely

* American Journ. of Med. Sciences, July, 1870.

than before, and protruded considerably beyond the other eye. One day later the right eye also began to bulge, and soon protruded as much as the left.

The intense headache, incessant noise, and the bulging of both eyes had lasted several weeks, when she summoned medical aid. Dr. Acheson, of this city, treated her for some time, and succeeded in relieving the pain. Her general condition also improved materially under treatment, and she was soon able to attend to her household duties, though the headache, noise, and protrusion of the eyes persisted, varying in degree at different times.

On May 11, ten weeks after the accident, I examined the patient and made the following notes:

The patient is very pale, and has an anxious expression of countenance. Both eyeballs are considerably pushed forward, and almost entirely covered by the distended, swollen, and intensely red upper lids, which can only slightly be raised by the action of the frontal muscles. The tarso-orbital folds are effaced. On lifting the upper lids the somewhat chemotic ocular conjunctivæ are seen traversed by dilated and exceedingly tortuous veins, radiating from the periphery of the cornea towards the transition folds. The left eye presents an exophthalmos of at least 6'', and an inward deviation of 3''. Its mobility outward is entirely abolished, and the inward, upward, and downward movements are limited, not amounting to more than 1'' in any one of these directions. The cornea is clear. The iris has a greenish hue, and appears swollen. The moderately dilated pupil does not respond to light. The anterior chamber is of normal depth. The lens shows an opaque stripe in the posterior cortical substance. Vitreous clear. The fundus exhibits the typical picture of choked disk. The papilla is swollen; its outline blurred. The retinal arteries are thin, almost filiform. The retinal veins are large and tortuous, and mark their course by a number of hemorrhagic patches in the adjoining retinal tissue. Tn. F. complete. Perception of colors good. Hm. $\frac{1}{2}$. S. $\frac{3}{8}$.

The protrusion of the right eye measures about 6''. The eye occupies the primary position, from which it moves slightly in every direction, no excursion amounting to more than one line. Its pupil is moderately dilated, and reacts very perceptibly, though somewhat sluggishly, upon the direct admission of light. The media are clear, with the exception of the posterior cortical substance of the lens, which shows a few opaque stripes. There is also choked disk, but without retinal hemorrhages. E. S. $\frac{3}{8}$. Tn. F. complete.

On auscultation an intracranial bruit is heard over every part of the

head, most distinctly, however, over the left temple and the corresponding eye. The bruit is transmitted through both common carotids, is heard everywhere on the neck, and loudest over these vessels. It consists of two distinct sounds, the one being continuous and purring, the other interrupted, synchronous with the diastole of the arteries, and puffing, not unlike a distant steam-engine at work. The continuous sound is heard over both eyes and temples, louder on the left than on the right side, but not at all over the other parts of the head or neck. The interrupted puffing sound is heard from every part of the head and neck, but also more distinctly on the left than on the right side.

Compression of the left common carotid stops the noise completely. Compression of the right common carotid reduces it considerably. The patient is pleased with either measure, and expresses her gratification at the instantaneous relief from the incessant noise. Prolonged pressure upon the left carotid causes dizziness, faintness, even complete syncope. Pressure upon the right common carotid produces no such effects. When the hand is placed over either eyeball, and slight pressure exerted, a marked thrill is felt. The left eyeball shows rhythmical pulsations only at times, especially after some bodily exertion, or in moments of mental anxiety. The right eyeball does not pulsate. By palpation no circumscribed tumor can be felt in either orbit. By firm pressure upon the eyes much annoyance and pain is caused, but not the slightest reduction of the exophthalmos effected.

When the patient inclines her head or body forwards, no increase of protrusion ensues. In the recumbent position she is more incommoded by the noise than in the erect. The patient hears badly. The tick of my watch (hearing distance 5') is neither heard by conduction through the air nor through the bones of the head. She understands what is spoken with a loud voice, but says that every sound seems drowned in the noise.

The drum membranes are dull, sunken, and devoid of their light spots, but perfectly movable.

The Eustachian tubes are permeable. She heard well before the fall.

The examination of the chest shows nothing abnormal. The lungs are sound. The area of dulness in the region of the heart is not increased. The heart-beat is felt in the fifth intercostal space a little to the left of the nipple. The first sound appears somewhat veiled.

Taking into account the symptoms occurring in this case from prolonged compression of the left common carotid, I could at that time neither resort to continued digital pressure nor to ligation. As a preliminary step it seemed to me necessary to establish a sufficient collateral circula-

tion in the left side of the head. This I hoped to accomplish by brief and frequently repeated compression of the left common carotid. Accordingly I taught the patient to compress this artery, and directed her to release the pressure as soon as dizziness or faintness appeared.

During the first few days compression was badly borne, and could only be made in periods of two or three minutes. After five or six days it was possible to continue it for hours without producing the symptoms mentioned above. At this juncture, since neither the exophthalmos nor the bruit had been in the least reduced by the interrupted compression, and sight had even been more impaired, I urged the patient to submit to the operation of ligation of the left common carotid. She wished to consult her family, left my office, and did not return.

Two weeks later, June 6, I was summoned to her house. I found her in bed, utterly prostrated, with all her symptoms aggravated, and entirely blind. The exophthalmos had still increased. The ocular conjunctivæ protruded between the lids, forming thick and fleshy masses overlapping the lower lids. The eyes were perfectly immovable, the pupils moderately dilated and irresponsive to light. No quantitative perception of light. I was informed that the absolute blindness had then existed three days. The ophthalmoscope showed the choked disks as before, but still more pronounced; the retinal arteries were not visible, and in the left eye the venous hemorrhages had increased. The intracranial noise had not changed in character, but gained in volume. Compression of the left common carotid still caused great relief, by entirely stopping the bruit and the violent frontal headache (supraorbital neuralgia). I proposed the immediate ligation of the left common carotid. To this she did not yet accede, but waited two days, and then, June 8, applied for admission as an indoor patient to the Ophthalmic and Aural Institute.

In the afternoon of that day I ligated the left common carotid without anæsthesia, in the presence of the gentlemen connected with the Institute, Drs. Knapp, Pooley, Gebser and Sattler. The operation offered but little difficulty. Above the omo-hyoid the distended and strongly pulsating internal jugular vein covered the artery entirely. For this reason I chose the point of ligation immediately below the omo-hyoid, where the artery was not overlapped by the vein. The form of ligature chosen was Lister's carbolized catgut. When the ligature was tightened the bruit ceased immediately. No unpleasant symptoms became manifest. I had just cut short the ends of the ligature, and began to close the wound, when the woman exclaimed, "Doctor, I can see you!" On examination I found that she could count fingers with either eye at a distance of fifteen feet. Both visual fields were complete. Having closed the

wound by eight interrupted sutures, I noticed that the lids of both eyes had lost their tense and shining appearance, and become soft and wrinkled. The conjunctivæ, though as much swollen as before, looked much paler. There was no change in the appearance of the fundus of either eye. The operation was completed at 4 P.M.

At 10 P.M.—Pulse 90. Tem. $100\frac{1}{2}^{\circ}$. Patient is comfortable; absolutely no bruit; no headache; slight pain in swallowing.

June 9, Morning.—Pulse 108. Tem. 101° . Patient slept but little during the night. No bruit; no headache; no pain in wound; great pain in swallowing. The exophthalmos has diminished considerably, the eyes are only slightly prominent, the lids are relaxed and wrinkled. Less chemosis. Slight reaction of both pupils. Function of ocular muscles restored, with the exception of the left rectus externus. The retinal veins are smaller and less tortuous, the arteries just visible. Papillæ less swollen. Sight and hearing improved.

Evening.—Pulse 108. Tem. $101\frac{1}{4}^{\circ}$. Appearance of wound favorable. Pain in swallowing very slight.

June 10.—Pulse 108. Tem. in axilla $101\frac{1}{4}^{\circ}$; in right external auditory canal $100\frac{3}{4}^{\circ}$; in left $99\frac{1}{4}^{\circ}$. Patient slept well during the night, feels well, and has no pain in swallowing. Wound has healed by first intention. Hemorrhagic patches in left fundus smaller.

June 12.—Pulse 86. Tem. 99° . No bruit. Sutures removed.

June 16.—Pulse 86. Tem. $99\frac{1}{2}^{\circ}$. Exophthalmos and chemosis have entirely disappeared. Left eye more deeply set in orbit than right. Left abducens still paralyzed. R. S. $\frac{2}{6}$, L. $\frac{2}{6}$. Wound firmly closed, free from irritation.

June 19.—Patient has left the bed. No trace of choked disk. Left papilla whiter than normal. Retinal arteries and veins of ordinary size. Hemorrhages, in left eye absorbed; no bruit.

June 27.—Patient discharged. S. R. $\frac{3}{8}$, L. $\frac{2}{10}$. Atrophic discoloration of left papilla; no bruit; no exophthalmos. Mobility of ocular muscles and upper lids normal, with the exception of the left rectus externus which is still paralyzed. Pupils react readily, veins of ocular conjunctivæ still large and tortuous; no chemosis. Hearing, R. ear watch 4". Left ear 3".

After her discharge from the hospital the patient remained under my observation until this day, Nov. 10, 1875. Her general health continued to improve. In October the paralysis of the left abducens disappeared, and both eyes have at present—five months after the operation—a normal range of mobility. During this time the patient never complained of noise in the head, though I occasionally detected a faint intracranial

blowing sound, especially when I auscultated the head after she had walked briskly. The left eye is more deeply set in the orbit than the right, but there is absolutely no exophthalmos. Sight and hearing remain unchanged. R. E. S. $\frac{20}{30}$, L. Hm. $\frac{1}{20}$, S. $\frac{20}{100}$. She hears the watch with either ear at 4".

The analysis of the symptoms presented in this case, together with the result obtained from the operation, led me to suppose that I had to deal with a direct communication between the left common carotid and the cavernous sinus. The patient had sustained an injury causing successively unconsciousness, headache, bleeding from both nostrils, paralysis of the left abducens, intracranial bruit, protrusion first of the left and then of the right eyeball, paralysis of all the other motor nerves of both eyes, supra-orbital pain and deafness. With a high degree of probability I may assume that the injury resulted in a fracture at the base of the brain, involving the left common carotid in the region of the sella Turcica. Here the internal carotid artery lies in close contact with the bone, and traverses the cavernous sinus. Between the outer wall of the artery and the inner wall of the sinus passes the sixth nerve, which, in our case, became paralyzed before the exophthalmos, and the bruit had supervened. This may be explained by the supposition that the weakened parts of the artery yielded under the normal arterial pressure, and by their distention compressed the sixth nerve. When finally the rupture of the artery occurred, and the arterial blood passed freely into the sinus, the resulting enormous pressure within this venous channel was transmitted to the left ophthalmic veins, which becoming distended caused exophthalmos by their increase in calibre and through œdema of their surrounding tissues.

The continued pressure within the left cavernous sinus, causing first collateral congestion in all the venous channels at the base of the brain, must also have been directly transmitted to the circular, transverse, right cavernous, and petrosal sinuses. Thus the occurrence of right exophthalmos may be ascribed to the repletion of the right cavernous sinus, and the symptoms of paralysis of all the motor nerves of both eyes, and of irritation of the first branch of the fifth nerve to the distention of the walls of the cavernous sinuses, and the pressure thereby exerted upon these

nerves. The deafness may be due to the congestion of the petrosal sinuses.

With the symptoms of the case before us, we could certainly not have been tempted to seek the seat of the lesion within the orbit, and assume an improbable symmetrical affection. If, on the other hand, we consider the absence of all cerebral symptoms and the rapid disappearance of the pathological conditions of both eyes, we can neither suppose the existence of true or diffuse aneurism of the left internal carotid, nor of both internal carotids, within the cranium. Thus both by the analysis of the symptoms and the process of exclusion, we are led to the probable diagnosis of intra-cranial arterio-venous communication.

A CONTRIBUTION TO THE NOSOLOGY AND TREATMENT OF SYMPATHETIC OPHTHALMIA.

BY DR. J. SAMELSOHN, OF COLOGNE.

(Translated by Dr. H. Bendell, of Albany, N. Y.)

FOR instruction in sympathetic ophthalmia, the publication of accurately kept records of cases still remains a task worthy of credit, as only through such, a union of opinion on the many contended points can be brought about. Prominently important among these points is the question, At what stage of the disease is a sympathetic affection of the healthy eye to be feared? For the final solution of this prognostic problem, on which our therapeutic procedures depend, a careful record of cases, anatomical as well as clinical, is of the utmost importance, as already forcibly demonstrated by V. Graefe in his latest work on Sympathetic Ophthalmia (*Archiv für Ophthalmologie*, XII., 2, p. 152). The remaining questions in which cases prophylactic enucleation is indicated—if the enucleation of the already sympathetically inflamed eye would prove beneficial; if in cases of only partial amaurosis of the diseased eye the same would be justifiable; what forms of sympathetic affections are met with—these and many other questions are absorbed by the above prominently important question, in which, in fact, they are embodied.

The following case, a rarity on account of its favorable termination, will aid us in the discussion of this subject:

On the 1st of April, 1874, Karl P., aged 14 years, while playing at hoop, was injured by the elastic end of a hoop rebounding with great force against his left eye. Next day the lad was brought before me, when the following *status præsens* was ascertained: Close to the outside of the sclero-corneal junction, in the horizontal meridian, though still in the region of the sclerotic, was a small lacerated wound, about two millimetres in circumference, filled by a small prolapse of the iris; there was marked peri-corneal injection; profuse lachrymation; on pressure, com-

paratively little pain of the ciliary region; intra-ocular tension partially diminished; cornea and aqueous humor clear; the brown iris is apparently neither discolored nor swollen; pupil eccentric, narrow, and pear-shaped, with the point drawn toward the wound. The interior of the eye could not be illuminated; not a particle of reflection from the fundus; sight diminished to such an extent that fingers cannot be seen or counted in any direction, though the smallest light of a lamp in a darkened room is perceptible in every direction, except in that corresponding to the seat of injury.

Diagnosis.—Hemorrhage and cloudiness of the vitreous; probable detachment of the retina, and perhaps of the choroid, at the point corresponding to the injury. Though the consistency of the eyeball was not materially diminished, detachment of the retina was probable. The limitation of F., mentioned above, was not caused by a clot, and the affected region yielded no phosphènes. Under these circumstances the prognosis was very reservedly made, and in consequence of the injury being evidently in the region of the ciliary body, the possibility of a sympathetic affection of the right eye was mentioned.

Treatment.—Atropine, compressive bandage, as the prolapse of the iris was too small to admit of amputation. To guard against the severe ciliary neuralgia and the marked peri-corneal injection, four leeches were applied to the outer and inner corners of the eye. Natr. sulf. and confinement in a darkened room ordered. Next day the pupil was well dilated, the ciliary neurosis had disappeared, but the pericorneal injection was increased; fundus of the eye not yet visible on ophthalmoscopic examination. An examination of the left eye proved a total absence of reflection from the lens, so that a cloudiness or covering of its capsule, owing to a fine exudation or extravasation, might be surmised, or a total dislocation of the lens be inferred. No change took place during the following four days, except that the pupil, notwithstanding the frequent application of atropine, again became contracted, the tissue of the iris became swollen, without, however, producing any change in its color or flexibility. Six days after the accident a small hypopyum made its appearance, whereupon the pupil again was dilated. No particular inflammatory paroxysms seemed to accompany the repeated appearance of this hypopyum; on the contrary, they gradually disappeared, and the lachrymation ceased. The neuralgia and the painfulness of the ciliary body to the touch, which had never been very marked, totally disappeared, the peri-corneal injection diminished, the pupillary region became sufficiently clear and a yellow-gray reflex from the nasal side of the eye was perceptible, whilst the temporal side still appeared totally obscure. This opacity

was in front of the point of rotation of the eye, as in eversion of the eye all appeared obscure, whilst in inversion the whole pupil could be illuminated. Vision so improved that fingers held to the outer side of the eye could be counted at the distance of one foot.

Patient remained in this uncertain condition until the first week in May, when a violent inflammatory reaction took place ; the pupil became contracted, numerous pupillary adhesions were formed, with hypopyum, ciliary neurosis, painfulness by pressure of the ciliary region, and increased intra-ocular tension. The acuteness of vision, which a few days previous to this relapse had so improved that Jäger No. 23 could be deciphered eccentrically outward at a distance of one foot, whilst central vision, and the inner part of the field of vision, to the extent of an angle of 120 degrees, were still wanting, again became so diminished that fingers could only be counted with difficulty ; correspondingly, the ophthalmoscopic reflex to the inner side became dimmer. On the 9th of May, a sudden abatement of the relapse occurred, with rapid diminution of the previously mentioned intra-ocular pressure ; at the same time the hypopyum disappeared, the pupil dilated *ad maximum*, showing on the inner border three tongue-shaped posterior synechiæ ; ophthalmoscopic reflex from the interior of the eye brighter, reflection from the lens weaker, but perceptible. On the same day, that is, with the remission of the inflammation in the injured eye, there appeared on the right healthy eye a delicate peri-corneal redness, accompanied with slight photophobia, but without any diminution of the acuteness of vision. Though this disappeared on the next day, greater care was recommended. May 5th, re-appearance of the peri-corneal injection ; simultaneous with this, appearance of punctiform deposits on the membrane of Descemet in the lower third : $S. = \frac{3}{4}$. Field of vision complete, refracting media, except as affected by the above-mentioned deposit, clear ; ophthalmoscopic condition normal ; painfulness of the ciliary region on pressure not clearly defined on either side. In consideration of the undoubted sympathetic nature of this serous iritis, and in view of the evident loss of sight on the left (injured) eye, enucleation is recommended, but not submitted to ; application of atropine to the right eye ; strict discipline. The iris reacts promptly upon atropine, but now four small synechiæ make their appearance in the inner pupillary margin. Owing to these circumstances the proposition to enucleate is again urgently repeated, as through these synechiæ the transition from the serous to the plastic form of iritis is to be feared, but, as the parent's consent was absolutely refused, the patient was admitted to the hospital on the 18th for more careful treatment and observation.

Treatment.—Darkened room; continual confinement to bed; atropine to both eyes. Under this treatment the peri-corneal injection soon diminished, the refracting media of the left eye became cleared to such an extent that the outlines of the optic disk could be indistinctly seen, while the dense cloudiness continued on the outer side; field of vision unchanged; acuteness of vision so improved that Jäger No. 23 could again be deciphered as before; intra-ocular pressure nearly normal; on the other hand, susceptibility so great that the slightest touch on the eyeball produced a deep peri-corneal injection. $V. = 1$; the gray-white deposit on the membrane of Descemet quite marked; the adhesions, with the exception of one small, white, reflecting, tongue-shaped synechiæ, torn. In this condition patient was discharged on the 29th of May, with prognosis doubtful. During the next week the refracting media of the left eye grew continually clearer, the field of vision became larger to the inner side, and vision continually improved. The deposit on the membrane of Descemet disappeared, and the only remaining synechia tore; application of atropine is discontinued on the right eye. On the left eye atropine is still applied daily. On the 20th of June all symptoms of irritation had disappeared. Patient returned to school, but remained under strict medical observation. At this time the condition of the patient was as follows: Structure of right eye normal; $S. = 1$; field of vision complete; in the left eye the prolapse of the iris is completely cicatrized with the cornea; this cicatricial spot is still painful on pressure; by pressure slight peri-corneal injection is produced; the iris is hazy in appearance; the pupil pear-shaped, with its point drawn toward the cicatrix; iris reacts promptly by the use of atropine, showing on the inner side three tongue-shaped synechiæ; lens and capsule perfectly normal. Ophthalmoscopic appearance (Fig. 1, p. 52): By simple illumination the reflex from the fundus is of a brighter yellow than on the right eye; to the outer side from above downward can be seen three immovable dark streaks. In the inverted image the optic disk and its outlines are sharply defined. The arteries are rather thin; the veins well filled, tortuous, and bent in their course; only two-thirds of the circumference of the outlines of the optic disc are sharply defined; the remaining third (exactly in the horizontal meridian) passes directly, without any line of distinction, in the form of an opaque streak (*a* in Fig.) horizontally outward towards the macula lutea. The upper and lower edges of this streak end abruptly, casting a dull white reflex, apparently emanating from the sclerotic; the retinal vessels pass intact across the apparent rupture; no deposit of pigment can be authenticated on the border of this rupture; a little above the macula lutea it ends in a triangular, dazzling white gap (*b*) with its

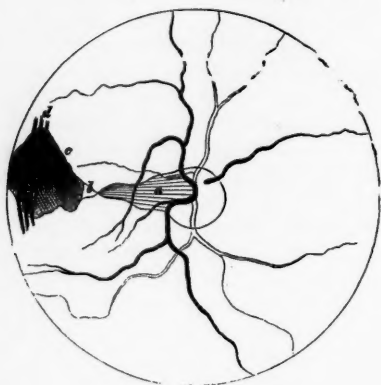


Fig. 1.

point turned upwards. Joined to this triangular gap is a detachment of the retina the width of double the diameter of the optic disc (*c*), which runs diagonally to the cicatrix, and can be traced to the three dark streaks (*d*) above mentioned; the light reflected from this detachment is of a bluish-green color; $S. = \frac{1}{2}$ with central fixation. The field of vision, tested at a distance of one foot, was contracted on the inner side. (See Fig. 2.)

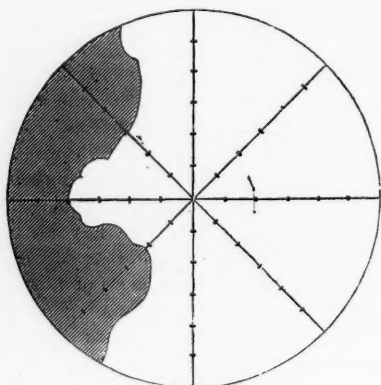


Fig. 2.

I concluded from this that from the injury a horizontal rupture of the choroid had resulted, which extended to the border of the optic nerve. The fact of this rupture being the broadest between macula lutea and the optic disk, corresponds with the nature of the injury. Owing to the manner of adhesion of the choroid to the sclerotic, the tension of the choroid must have been greatest at these two points. The rare occurrence of this horizontal direction of rupture of the choroid appeared to be developed by the nature of the accident: the hoop had undoubtedly struck the eyeball in the horizontal meridian, and while turned to the inner side, made a furrow in it, which ruptured the tense choroid, not through contre-coup, but by direct force. The rebounding end of the hoop struck the sclerotic directly at the corneal border, and probably at the same time (by expansion) severed it from the cornea. The detachment of the retina between the macula lutea and the ciliary body, may have had a double origin; either the direct effect of the injury, or indirectly as the consequence of cicatrization of the choroidal rupture.

This result of my ophthalmoscopical examination sustained, however, an essential modification through an examination; to which I subjected the patient after more than a year had elapsed. During this whole time, both eyes had remained free from inflammation, although the patient had in the meantime left school, and was now serving as apprentice in a business where his eyes were put to constant use. An examination on the 14th of July, 1875, disclosed the following:

The right eye, in structure and function perfectly normal; pupil reacts promptly and shows no sign of synechiæ; left eye S. = $\frac{1}{2}$; field of vision little changed since last examination; the pear-shaped pupil reacts promptly, and an application of atropine shows the three synechiæ before mentioned. The lens is clear and shows a bright reflection; ophthalmoscopic examination now discloses the following: Beginning at the point of emergence of the blood-vessels of the optic disk, I find three parallel, yellow, white folds on the outer side, which, owing to displacement, are distinctly manifest as lying before the nerve and retinal surface; beneath these, the white reflection of the sclerotic can be seen; these folds converge towards the macula, and end beyond and somewhat above it in a triangular, dazzling, white spot, the base of which is horizontal, with point extending upwards; this spot appears distinctly as being the sclerotic; the side turned toward the optic disk serves as insertion for

the three mentioned folds. This white spot, which in the erect image has the dimension of an equilateral triangle, any one side of which is equal in length to one-fourth diameter of the optic disk, is bounded by a red spot, at least $1\frac{1}{2}$ times the breadth of the optic disk, and surrounded by a circle of pigment; from this triangular spot, which indicated a macerated condition of the choroid, denuded of the retina, radiated an object fan-shaped in its beginning, of a bluish-green color, and of the form of a crooked cylinder extending into the otherwise clear vitreous space, and after turning its convexity to the front, turns back towards the region of the ciliary body, into which it is apparently inserted; this insertion must, however, be situated behind the ciliary processes, because through the contorted pupil the outer edge of the lens can be distinctly seen, and it is thus recognized that on this side of the above-mentioned opacity (which is evidently nothing but a pseudo-membrane in the vitreous) the fundus appears red.

According to this condition, which may now be looked upon as likely to continue, I must considerably modify the above interpretation. The spot marked *b* in Fig. 2 remains doubtless the sclerotic. The adjoining patch, supposed to be a detachment of the retina, dissolves into an opacity of the vitreous, which may possibly have its termination in the described degeneration of the choroid, which, in turn, appears to be the consequence of the traumatic destruction of the retinal and choroidal tissues. Even though the spot marked "*a*" remains a choroidal rupture, the explanation of the folds will be subject to many difficulties, because these folds, as described, extend as far as the centre of the optic papilla. Whether this is a case of ophthalmoscopically evident detachment of the vitreous, according to Iwanof, I dare merely hint at this time.

The foregoing communicated might arouse the interest of the practitioner to a great extent, being an example of a rare and satisfactory termination of a severe injury of the eye, as well as a solution, in a non-operative way, of a sympathetic process; for although the serous form of sympathetic iritis of our case is counted amongst the lesser of the sympathetic affections, and one of which V. GRAEFE (l. c., p. 170) says, "that it is a matter of doubt to him if this form ever develops into the malignant, even when enucleation is not performed." I must nevertheless confess, that with the appearance of the first synechia,

the evidence of development of malignant irido-cyclitis was given,* and the responsibility of the physician could be no less urgent nor unpleasant. But the situation becomes totally overwhelming for the physician when, as in this case, with the appearance of the first sympathetic inflammation the sight of the primarily affected eye diminishes to such an extent that a restoration of it can scarcely be thought of. The necessity of enucleation seems then so much more imperative, as in this form of sympathetic iritis (according to V. Graefe) we may promise that the sympathetically affected eye can be saved, which we cannot in the malignant form. That I did not enucleate in this case, under the existing circumstances, was owing wholly to the unconquerable opposition of the patient's relatives, and that they were finally right, proves amply that we are yet at the alpha as to prognosis in sympathetic disturbances, and that the therapeutic rules which at this day govern prophylactic enucleation are still very uncertain. If we even no more than cursorily examine the views of authorities on this point, MACKENZIE (*Traité pratique des Maladies des Yeux*, 1844, p. 429) definitely declares that he has never seen a sympathetic affection terminate favorably; and it is this depressing observation that prompts him to recommend the destruction of the injured eye. MOOREN (l. c., p. 78) regards enucleation as the foundation of every therapeutic procedure, as sympathetic inflammation never appears until the sight of the injured eye is totally destroyed. This assertion is at variance with my own experience and that of others; as for instance two cases of V. GRAEFE, in which he did not enucleate because the perception of light in the injured eye, although materially diminished, was not totally destroyed, and in which a favorable termination of the sympathetic affection by operative means was attained; furthermore, T. R. POOLEY reports a case (Archives of

* MOOREN describes a case in which the transition of a sympathetic attack of serous iritis, notwithstanding previous enucleation, developed into the malignant form; consequently the above-mentioned opinion of V. GRAEFE, which has also been accepted by DONDEERS, can be refuted. (*Sympathische Gesichtsstörung*, 1869, p. 86.) Likewise the case reported by Hirschberg (*Klinische Beobacht.*, 1874, p. 34) strengthens my opinion that the appearance of the first synechia may be considered as the beginning of the malignant form of irido-cyclitis, and for this reason the absolute proposition to enucleate was justifiable.

Ophthalmology and Otology, I. 2) in which after an injury to the left eye, a sympathetic ophthalmia of the right eye, with subsequent absolute amaurosis, appeared, while the primarily injured eye regained a moderate degree of sight; finally, the last published case of HENRY POWERS (O. H. R., VII., p. 443-450) in which, after an injury to the left eye, a small prolapse of the iris caused a sympathetic affection of the right eye, which, notwithstanding the imperfect description, appeared to have been an attack of serous iritis. Judging from his description, it seems to me that the punctiform opacities, which by ophthalmoscopic examination he discovered on the lens, might very properly be looked upon as deposits on the membrane of Descemet; in this case the sympathetic ophthalmia was cured without operative interference, and the sight on both eyes fully restored. These observations (the last of which coincides very much with my case) go to support the advice of V. GRAEFE, to abstain from operating in all cases in which the least vestige of sight yet remains in the injured eye. The uncomfortable dilemma out of which this advice is calculated to lead the practitioner will nevertheless be experienced with every new case, and the results will not always be so favorable, as in the case above described.*

A consideration of some of the theoretical points connected with the sympathetic process will be of no less interest than that of the practical points. If we return to the question suggested at the beginning, viz.: by which form of disease of the injured eye sympathetic ophthalmia might be produced, we have in the above case an extremely complicated and extensive lesion: rupture of the choroid and retina, organized opacities, and probably also detachments of the vitreous, and finally an injury of the ciliary body with prolapse of the iris. Experience has taught us that particularly the last-named injury is a frequent source of sympa-

* I cannot refrain from referring to the views of V. GRAEFE, which are verified by this case, as it appears to be the unmistakable tendency of the day more and more to enlarge the field of enucleation in a prophylactic as well as curative point of view. I am reminded in this connection of the experience of R. BERLIN in the treatment of foreign bodies in the eye; of the remarks of A. PAGENSTECHER: that the boundary lines of the indications for enucleation in sympathetic affection cannot be too widely drawn. Against this view the experience of nearly every ophthalmologist might offer striking arguments; the critical appreciation of which is still a desideratum. What we want in the first place is an abundance of carefully recorded cases.

thetic inflammation, especially when its seat is at the sclero-corneal junction ; while, on the other side, injuries of the other parts mentioned commonly have no tendency to transmit the irritation. If we suppose in our case the injury of the ciliary body to have been the cause of the sympathetic affection, this supposition becomes a certainty when the course of the affection is more thoroughly examined. We find the injury closely followed by a form of inflammation, which we can interpret as nothing but a cyclitis, though not as the hyperplastic form, upon which, according to V. GRAEFE, MOOREN, and others, the possibility of sympathetic transmission depends. But the school definition of cyclitis is still so vague (as I attempted to demonstrate in another place),* that we must, in this case, be satisfied with simply proving its existence. Of the cardinal symptoms enumerated by V. Graefe as pathognomonic of cyclitis, but few could be authenticated in our case. The peculiar painful sensation upon palpation of the region of the ciliary body, during the time the patient was under treatment, was but trifling, likewise the sudden appearance of floating opacities in the vitreous could not be detected ; the dimness of the ophthalmoscopic reflex accompanying the relapse can be explained as being caused by the contraction of the pupil. On the other hand, the symptoms which engaged our attention most, viz. : the rapid appearance and disappearance of the hypopyum with alternating contraction and dilatation of the pupil, without producing any corresponding alterations in the tissue of the iris, is sufficient to justify the diagnosis of cyclitis. Here we have a case where not a hyperplastic cyclitis, with retraction of the ciliary processes and ciliary margin of the iris, but an exudative form (hypopyum-cyclitis) becomes the conductor of the sympathetic process, and in this our observation seems to furnish material for the extension of the sphere of sympathetic affection. For if the hyperplastic form depends on irritation of the ciliary nerves, in consequence of the contracting cicatricial tissue, that modification of the nervous irritation, which manifests itself by sudden changes of the intra-ocular pressure, is illustrated in our case, as its history conclusively proves. At the beginning we find the pupil contracted, the intra-ocular pressure increased, and

* On Vaso-motor Disturbances of the Eye, *Graefe's Arch.* xxi. 1. p. 29, etc.

hypopyum present, whereas the decrease of the inflammation is manifested by dilatation of the pupil, diminution of the intra-ocular pressure, and absorption of the hypopyum. This complex of phenomena explains itself the most readily in a neurological way, even if in this uncertain field we find but few tangible points for more definite knowledge. The trigeminus and sympathetic have the power of influencing the pupil and intra-ocular pressure, and how manifold the circumstances and combinations caused hereby is best illustrated by the observation of certain forms of keratitis, in which, at the height of the inflammation, we find a contracted pupil, the tension of the globe diminished, and a total absence (viz., against atropine) of all tendencies toward resorption, while the decrease of the inflammation is marked by dilatation of the pupil, increased intra-ocular pressure, and high absorbing power. Though the latest works (LEBER) give us no explanation of these anomalies, we may judge from an examination of our case that the conduction of the sympathetic symptoms, by means of the ciliary nerves, is essentially increased by a sudden diminution of the intra-ocular pressure. Even this point was anticipated by the genius of V. GRAEFE. He says (l. c., p. 152), in mentioning the pathognomonic importance of the sensibility of the ciliary region to the touch : "Most frequently the tension of the eye first attacked is hereby perceptibly diminished ; it even appears that a considerable increase of tension, by reducing the power of conduction in the ciliary nerves, diminishes the painfulness of the ciliary region ;" and again (l. c., p. 153) : "So might, in fact, under certain pathological conditions, the diminution of the intra-ocular pressure prove favorable to the production of a sympathetic affection in the other eye."

If the above communication, as it seems to me, incontestably militates in the direction just discussed, it might not appear too great a venture to seek in the described form of cyclitis a cause of the relative harmlessness of the sympathetic affection. For if the changes which a hyperplastic cyclitis induces in the injured ciliary body, gradually increase, and eventually become permanent, it is to be inferred that the sympathetic changes depending thereon, once declared, will assume a progressive character ; while on the other hand, in that form depending on alternating secretory anomalies, all the changeable and quickly

passing irritating symptoms will, in the same way, induce transitory sympathetic changes corresponding to the nature of the affection. The anatomical condition seems to warrant such a conclusion ; in the one case, a discolored, disorganized iris, with strong retraction of its ciliary insertion ; in the other, a normal condition of the iris, a few adhesions, and a distorted pupil, caused directly by the injury.

Thus it is evident that a differential diagnosis of these two forms of traumatic cyclitis, if the future should confirm our views, would serve for guidance in the *prognosis* of sympathetic inflammation and in the *indications* for prophylactic enucleation with more positiveness than we enjoy at present.

As to the delicate question of the nature of the nervous action in sympathetic affection, the above observation demonstrates one fact only, namely, that it is not an inflammatory process creeping along the course of the nerves, since an inflammatory process could neither so suddenly nor so rapidly transmit the changes of the primarily affected eye to its fellow.

OPHTHALMOSCOPIC CONDITIONS IN BASILAR MENINGITIS OF INFANTS.

BY DR. J. HOCK,

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(Translated from the German, by H. Knapp.)

[Preliminary Notice.]

I HAVE observed the following conditions in the background of eyes of children whom Dr. A. Monti sent to my clinic with the diagnosis meningitis basilaris or tuberculosa.

Though I have not been able to confirm the diagnosis by post-mortem examinations of such children, though, furthermore, the number of cases which I have collected is relatively small, I think that the conditions observed by me are important enough to present them to the profession. This communication will, perhaps, be an incentive to discover under more favorable circumstances the causal relation between basilar meningitis and these ophthalmoscopic conditions.

The pictures, even those which I found in advanced cerebral affections that were near their fatal termination, are totally dissimilar from those which, after Von Graefe, have been termed "choked disc," or "*neuritis descendens*." Above all, the swelling of the optic nerve entrance is absent in all such cases, on account of which fact they cannot be classified among cases of *neuritis*. Moreover, the retina participates in the morbid process to a far greater extent, and in another manner than in the affections above mentioned.

This is the more surprising since VON GRAEFE observed that encephalitic and encephalomeningitic processes are complicated with that form of disease which he called "*neuritis descendens*." The conditions which I shall have to describe differ essentially also from the statements of BOUCHUT, who alleges having seen

œdema of the optic disc, considerable dilatation of the retinal veins, and occasional hemorrhages in the disc and retina during the "*période d'invasion*" of granular meningitis.

I shall restrict myself to the simple description of what I have observed, without making any hypothesis as to the origin of the fundamental morbid processes or discussing any theories relating to the connection between diseases of the brain and of the background of the eye.

Condition A.

The entrance of the optic nerve, seen in the inverted image, appears yellowish-red, dull, lardaceous, which coloration manifests itself by the investigation in the upright image (with weak illumination) as the effect of a delicate crape-like opacity of the optic-nerve fibres which leaves the central excavation of the disc clear. The outlines of the disc are distinct, though not so sharply defined as in the normal condition; the level of the disc is not raised. The calibre and course of the retinal arteries are perfectly normal; the retinal veins are dilated, darker, and more tortuous than usual, but remain in one plane, being uniformly visible in all their parts. The part of the retina surrounding the optic disc appears somewhat opaque (about so as it sometimes appears at the inner or upper margin of the disc in normal eyes). At a short distance from the disc the fundus is perfectly clear and healthy.

Condition B.

By weak illumination, the fundus yields a dull yellowish-red reflex, as though a diffuse opacity of the refracting media were present; by strong illumination this reflex varies from grayish-yellow to gray. Corresponding to this condition the optic disc and the retina, as far as the extreme periphery of the retina, are covered with an opacity through which the outlines of the disc can be distinctly recognized, but not the delicate details of the fundus. The optic disc is redder, but not raised, its vessels are as in *A*. The retinal veins, especially those near the periphery, appear dark-red, almost black. The lustrous waving retinal re-

flex is very marked and accompanies the vessels to their smallest visible divisions. The retina itself is gray or blackish-gray in such a way that often nothing but the deep-dark vessels and the accompanying retinal reflex are seen.

Condition C.

(According to a case of advanced meningitis in the stage of sopor.)

Color and level of optic disc as in *A*.

The retina around it is raised like a circular ridge on which the blood-vessels ascend in curves. This ridge casts a shadow upon the area of the disc on that side which is turned from the light. The circular ridge is slightly opaque, totally different from the intensely opaque and red swelling in neuro-retinitis, and admits of recognizing every part of the blood-vessels that pass over it. The opacity of the retina extends a short distance toward the periphery.

In placing these three conditions in the succession of *A*, *B*, and *C*, I did not entertain the idea that the last described condition was only a farther developed stage of the same affection, since I had repeated opportunities of observing the condition *A* in children during the last stage of meningitis; but I believe that these conditions in the order I have placed them, represent diseases of less or greater importance, for the morbid process in *A* is limited to a small portion of the background of the eye and has changed the affected parts but little, whereas the conditions in *B* and *C* show more extensive and more important alterations.

OPHTHALMOLOGICAL REVIEW.

By H. KNAPP AND E. GRUENING.

1. BRECHT, DR. of Berlin. On the Reflex around the Macula Lutea. (*Graefe's Archiv*, xxi., 2, pp. 1-26).
2. HYRTL, JOS. Die Corrosionsanatomie und ihre Ergebnisse. The Lachrymal Apparatus. (*Wien. Braumüller.*)
3. PAULI, RICHARD, DR. Beiträge zur Lehre vom Gesichtsfelde. (München, 1875.)
4. HIRSCHBERG, J. Zur Semidecussation der Sehnervenfasern im Chiasma des Menschen. (*Virch. Arch.*, vol. lxx., p. 116.)
5. SAMELSON, J. On the Mechanical Treatment of Detachment of the Retina. (*Centralbl. f. Med. Wiss.*, 1875, p. 833.)
6. DÜRR, EDUARD DR. Ueber die Anwendung der Kälte bei Augenkrankheiten. (Hannover, Carl Rümpler, 1875.)
7. WALB, H. Ueber Tuberculose der Conjunctiva. (*Klin. Monatb. f. Augenh.*, xiii., Juli, 1875.)
8. TAYLOR, CHARLES BELL. Observations on Miners' Nystagmus. A new disease. (*The Lancet*, June 12, 1875, p. 821.)
9. HEIBERG HJALMAR, PROF. Ein Fall von Panophthalmitis puerperalis bedingt durch Micrococcus. (*Centralblatt f. d. Med. Wissensch.* 1874, p. 560, etc.)
10. STEFFAN. Clinical Notes. (*Die Steffan'sche Augenheilanstalt zu Frankfurt am Main*, 1873-74.)
11. LANDSBERG, DR. M., of Berlin. Zur Casuistik des Netzhautglioms. (*Graefe's Arch.*, xxi., 2, p. 93.)
12. HUTCHINSON, JONATHAN. Intra-cranial Aneurism. (*Medical Times and Gazette*, May 22, 1875, p. 563.)

1. B. analyzes the different reflexes which we see with the ophthalmoscope in the background of the eye, especially those in and around the yellow spot. In the centre of the fovea centralis of children there appears a small light spot which is a physical image by reflection from the concave surface of the fovea centralis. Around the fovea centralis he sometimes observed a white ring which is due to the change of curvature in the place where the conically depressed fovea passes over into the shallow spherical depression of the macula lutea. This reflex is not

mentioned by previous authors. The elliptical bright reflex at the periphery of the yellow spot is the result of direct reflection from the "polar" region, that space from which rays directly reflected return through the pupil. If the region of the macula were not depressed this polar region would appear as a uniformly bright disc. In a case of extra-ocular atrophy of the optic nerve, the bright ring was replaced by a dull lustre which covered the whole polar region as far as the limit of the fovea centralis. In cases of extra-ocular atrophy there is a waste of the layer of the nervous fibres and the ganglionic layer, whereas the other layers of the retina are preserved. In such cases the differences of level between the yellow spot and the surrounding retina disappear, while the depression in the fovea centralis remains. The reason of this is that, physiologically, in the region of the yellow spot the fibrous and ganglionic layers only are wanting, but in the fovea centralis the other retinal layers also disappear down to the columnar layer. The shallow depression in the region of the yellow spot deflects the directly reflected rays in such a way that they cannot return through the pupil, like those in the immediate vicinity of the yellow spot. The zone which causes the bright elliptical reflex is not raised over the surrounding retina. Its breadth depends on the width of the pupil: a large pupil causes a larger reflecting polar region than a small pupil. In fact, the elliptical bright zone broadens when the pupil dilates, it being, as it were, the image of the pupil. The author explains these conditions by geometrical demonstrations, and corroborates them by experiments upon a model eye. When he inserted into this apparatus a larger pupil, the reflex zone became larger, when he inserted a quadrangular pupil, it became quadrangular.

He further mentions the bright reflex which in many, especially dark eyes, is seen alongside the retinal blood-vessels. It always is on that side of the vessel which is turned from the yellow spot; in the inverted image it therefore appears on the side turned toward the yellow spot. This reflex is caused by the convexity which the blood-vessel produces in the limiting membrane of the retina.

That these reflexes are less distinctly or not at all seen in the erect image, is explained, with LORING, as the result of the insufficient intensity of illumination which is inherent to this method. He adds that the examination of the macula in the erect image is difficult on account of the narrowness of the pupil, and when we dilate the pupil the elliptical reflex loses its brightness or disappears altogether, since then a greater quantity of peripheral rays are reflected from the yellow spot through the pupil, thus reducing the contrast between the yellow spot and its surroundings. H. K.

2. Casts of the efferent lachrymal apparatus show a spiral furrow

in the canaliculus, and a corresponding ridge of mucous membrane. The narrowest point of the canaliculus is at a distance of 2 mm. from the punctum. In the lachrymal sac the mucous membrane forms a valve-like fold which is continued into the nasal duct in spiral turns. E. G.

3. In the introductory historical sketch, PAULI alludes to the merits of Albrecht von Graefe, who first recognized the significance of a thorough knowledge of the central and peripheral fields of vision, and took the initiative in those fertile researches of which the vast bibliography annexed to this monograph bears witness. The various methods of determining the extent of the field of vision are clearly described, and the histories of thirty patients, and the results of the perimetrical measurements of their fields of vision, given in a minute, yet perspicuous manner. The functions of the peripheric retinal regions are to be explored with regard to the perception of light, form, and color. Concerning color, P. corroborates the results of the perimetrical measurements of *Schön*, who found a certain constant relation in the peripheral limits of the different colors. Green shows the smallest, blue the largest field. The succession of colors, according to the extent of the field, from the smallest to the largest, is as follows: Green, red, orange, purple, violet, yellow, blue. For the perception of green the highest, for the perception of blue the lowest degree of energy of the sense of color is required. E. G.

4. HIRSCHBERG describes the case of a man, æt. 60, who had suffered for four years from left-sided frontal headache, then from bilateral right-sided hemianopsia (hemiopia), aphasia, and right-sided hemiplegia. The line of demarcation of the defect in the visual field was sharp and vertical, a few degrees to the right side of the point of fixation, as in the celebrated self-observation of Wollaston. S. in the whole defect was O, in the whole of the preserved half of F. normal, no zone of transition in which S. was diminished. In the optic discs and retinae no abnormality whatever. The patient died two months and a half after the occurrence of the hemiopia. The post-mortem examination revealed in the frontal lobe of the left hemisphere a hardish tumor, the size of an apple, by nature a vascular gliosarcoma. The chiasm showed no conspicuous abnormality, either to the naked eye or under the microscope. The left optic tract, immediately behind the chiasm, was essentially thinner than the right, measuring only $4\frac{1}{2}$ mm. in width, whereas the right tract measured $5\frac{1}{2}$ mm.

Hirschberg concludes that this observation is at variance with the hypothesis of the total decussation of the optic nerve fibres in the chiasm, but in harmony with John Müller's supposition of a semi-decussation. H. K.

5. S. recommends, in cases of detachment of the retina, to close the

affected eye by a *compressive* bandage, and the other by a simple protective bandage. It should be renewed twice daily, and continued for three or four weeks, during which time the patient has to lie on his back. Soon after the beginning of this treatment, episcleral injection and ciliary neuralgia are noticed, immediately followed by extension of the contracted field of vision, increase of visual acuity, and reattachment of the retina. This recommendation is based on the results of 12 cases, and accompanied by some theoretical remarks. Detailed publication is promised.

H. K.

6. In the practice of medicine and surgery cold has been recognized as an important agent in combating a variety of pathological conditions. In ophthalmology its therapeutic use is almost entirely restricted to inflammatory processes of the conjunctiva. DÜRR tries to formulate indications for the application of cold in other forms of ocular disease. He prefers the ice-bag, *i. e.*, dry cold, to the water or ice compress. Cases of acute corneal disease, especially hypopyon-keratitis, occurring in vigorous persons, and the various forms of idiopathic, syphilitic, and serous iritis are greatly benefited by the steady application of the ice-bag, while rheumatic, recurrent, complicated and purulent forms of iritis, iridocyclitis, irido-choroiditis, sympathetic inflammations, glaucomatous and atrophic conditions contra-indicate the use of cold.

All forms of choroidal inflammation (with the exception of *choroiditis purulenta*), hemorrhages, and inflammatory conditions of the retina, affections of the optic nerve, are favorably influenced by cold. In illustration of these principles the monograph contains the histories and results of treatment of forty-eight cases of various forms of ocular disease. Conclusive proof that the beneficial effects obtained were due solely to the action of cold is certainly not furnished, as the author does not limit his therapeutics to this agent, but resorts to a variety of topical and general remedies, for which equally good results are claimed by other writers.

E. G.

7. WALB publishes a case in which tubercles were formed in the ocular conjunctiva and nowhere else in the body. A boy suffered from an affection of the right eye after an attack of measles. The eye showed, besides chronic blennorrhoea and papillary swelling of the palpebral conjunctiva, a proliferation of the ocular conjunctiva in the upper equatorial region. The new growth was partially covered with epithelium, appeared pale red or yellowish in color at some points, and exhibited nowhere the deep red hue of an inflamed mucous membrane. Its surface was slightly uneven. Posteriorly the growth was more voluminous and had pushed the globe inward and downward. When the patient rolled his eyes

downward, portions of the tumor came into view which presented a different appearance. The most posterior portion of the growth lay on a much lower plane than the anterior, and the difference in level was very abrupt.

No blood-vessels could be seen, and whitish-yellow, cheesy masses covered the bottom of the ulcerous surface. Here the sclera was perforated, and a sound readily passed into the globe. From the appearance of the anterior portion of the globe it was judged that the growth had no intra-ocular origin. The cornea was transparent, the anterior chamber of normal depth, and the lens, though cataractous, had not been pushed forward. It was ascertained that no irritating agents had been applied to the conjunctiva. Shortly after this examination panophthalmitis supervened and destroyed the eye. The tumor was not materially changed by this process. Portions of the tumor were removed, hardened in Muller's fluid, and microscopically examined. They were found to consist of young connective tissue, composed of small round cells, and traversed by numerous blood-vessels. Roundish bodies, showing the structure of tubercle, were imbedded either singly or in groups in this connective tissue. The greater mass of these formations was composed of large epithelioid and often multi-nuclear cells, supported by a reticulum of fine fibres, which showed a certain regularity of arrangement. Toward the periphery the cells diminished in size and formed a sort of capsule of several strata, which separated the tubercle from the surrounding tissue. Further proofs of the identity of these roundish formations with tubercles were derived from the occurrence of giant cells and the arrangement of the blood-vessels. The patient was a scrofulous boy, who had recovered from caries of the right petrous bone and was still affected with enormous swellings of the lymphatic glands of the right side of the neck. His grand-parents had died from phthisis pulmonalis, and two of his brothers and sisters from basilar meningitis.

E. G.

8. Among the men employed in coal-pits TAYLOR has observed a number of cases of acquired nystagmus. He calls it "miners' nystagmus," and believes it to be analogous to writers' cramp. The affection does not depend upon other ocular defects, and is, as a rule, only to be noticed when the patient attempts fixation in a stooping position. The oscillating motions are caused by alternating contractions of the recti or oblique muscles, and are either horizontal or rotatory. The disease may be developed in any or all the muscles supplied by the third nerve, and is caused by the overtaking of these parts. The patient makes a great and sustained effort to see in an imperfect light; the muscles engaged in the accommodative strain are overburdened, in course of time give way,

and whenever called upon escape from the control of the will and perform irregular motions. Change of occupation and working in good light will effect a speedy cure of "miners' nystagmus." E. G.

9. HEIBERG examined an eye which had been affected with panophthalmitis puerperalis. The inflammation set in four days before the death (in consequence of pyæmia) of the patient, and pursued the usual rapid course. Pus was in the anterior and posterior chambers, and in the canalis Petitii. The corpus vitreum in the vicinity of the ciliary body was densely infiltrated with pus, whereas its posterior peripheric portion was only scantily infiltrated, and its centre quite clear. The retina was *in situ*, and showed numerous hemorrhages. Choroid and sclerotic were apparently normal. The microscope revealed in the cornea, besides the well-known conditions of purulent infiltration, accumulations of micrococcus in the interior of the corneal corpuscles (lymphatic canals), resembling the palmelloid forms of gliacoccus, recently described by BILLROTH (*Coccobacteria septica*, Berlin, 1874). In three or four places of the choroid were short, broad accumulations of zooglœa, manifesting themselves as the thrombotic (embolic) contents of the capillary blood-vessels. More than a dozen colonies of micrococcus were seen as cylindrical obturations in the retinal arteries, some of them surrounded by hemorrhages. H. thinks that the immigration, propagation, and development of micrococci constitutes the real "*materia peccans*" (the putrid poison) of the pyæmic (septicæmic) and puerperal affections. The reviewer does not recollect having seen such formations in pyæmic ophthalmia, but he possesses preparations of eyes taken from patients who died of Bright's disease, in which islets of choroidal capillaries were obstructed by a homogeneous, finely granular substance, resembling what is now described as micrococcus or bacteria. H. Müller, if his memory serves him, was the first who described these thrombotic obstructions of choroidal capillaries in eyes affected with Bright's retinitis. Time will show what part micrococci, which of late have attracted so much the attention of eminent pathologists, will play in the diseases of the eye. H. K.

10. DR. STEFFAN adds to the 13th Annual Report of his Ophthalmic Practice—both private and public—some instructive notes, from which we make the following selections :

Purulent Irido-Cyclitis, resulting from Incarceration of Iris in Cataract Section.—A woman, æt. 63, was operated on for cataract by VON GRAEFÉ'S method. The result was excellent, but iris was enclosed in one corner of the wound. Two years and four months later the eye was destroyed by spontaneous purulent irido-cyclitis, the cause of which, as Dr. S. alleges, was the incarceration of iris.

Acquired One-Sided Retinitis Pigmentosa.—The left eye of a woman, æt. 54, had suffered from syphilitic iritis in 1865, and was cured. In 1866, iridectomy was performed on the same eye for irido-choriditis, with diffuse opacity of the vitreous. Recovery. Seven years later she returned with Conjunctivitis phlyctænulosa of the other eye. The examination showed the interior of this eye perfectly healthy, whereas in the other, formerly diseased eye, the typical picture of retinitis pigmentosa was found, with concentric limitation of F., but without a trace of any inflammatory process.

Embolism of a Branch of the Retinal Artery.—The patient, in working, noticed a sudden impairment of the vision in one eye. The examination, three days later, discovered a defect in F., beginning a short distance above the point of fixation, occupying the upper-inner quadrant, and being separated from the remainder of F. by a sharp boundary line. S = 1. With the ophthalmoscope a plug was seen riding on the first division of the main inferior branch of the retinal artery. In spite of all treatment the ophthalmoscopic condition and the defect of F. remained unchanged.

Induced by the publication of HIPPEL on the *action of strychnia in the healthy and diseased eye*, Steffan continued his experiments with this highly-praised remedy, but neither before nor now did he obtain sure evidence of its therapeutic utility.

A case of *cholesterine crystals* in the vitreous of an eye which had no symptoms of inflammation. Its visual power was not materially influenced by the presence of the crystals.

The *atropine treatment* (gr. iv. ad. $\frac{5}{2}$ j., instilled three times daily for two weeks) gave no permanent result in 16 cases of *progressive myopia* in school children.

Sympathetic irido-cyclitis was caused by *sarcoma melanodes choroideæ*, implicating the ciliary body in the other eye of a man, 71 years of age. The sympathetic process, too far advanced, was not arrested by the enucleation of the sarcomatous eye.

A child, whose left eye had been removed for *glioma*, which was confined to the retina, showed no symptoms of a relapse 16 months after the operation, and, therefore, is pronounced *permanently cured*.

Tubercles in choroid.—A child had a febrile disease for six weeks, of too indefinite a character to admit of a positive diagnosis. Dr. S. found in the posterior part of the fundus of each eye six to eight roundish, whitish-yellow patches of $\frac{1}{4}$ to $\frac{1}{2}$ the diameter of the papilla. Their centre was bright, but their periphery merged gradually into the surrounding normal background. Six days later the patches had considerably in-

creased, and were raised above the adjacent tissue. Optic discs and retinae were unchanged. The diagnosis of miliary tuberculosis was confirmed by the autopsy.

Fibrosarcoma of Optic Nerve.—A woman of 30 years of age, healthy, had neuro-retinitis of one side, gradual loss of sight, a moderate degree of exophthalmus, headache, vertigo, vomiting. The exophthalmus disappeared, but inflammatory glaucoma developed. The eye was removed, together with a piece of the optic nerve 1 cm. in length, 7 mm. in breadth (instead of 5 mm., the normal standard). On the nasal side of the optic nerve was a tumor of 3 mm. in thickness, covered by the outer, but connected with the inner sheath of the optic nerve. The nerve had undergone fatty degeneration. The growth, the structure of which is rather insufficiently described by DR. FLESCHE, is styled a fibrosarcoma. Though it did not cease at the cut end of the removed piece of optic nerve, a relapse had not made its appearance 15 months after the operation. In compiling the literature on the tumors of the optic nerve, S. mentions the very remarkable case of a double-sided secondary carcinomatous growth of the optic nerve reported by KROHN in the *Klin. Monatsblätter*, 1872, page 93. This case seems to have attracted little attention.

H. K.

11. In a clinical material of 8745 eye patients, LANDSBERG observed four cases of glioma retinae. Two cases were operated upon at an early stage of the affection, and both patients lived at the time of the publication of the paper, *i.e.*, $2\frac{1}{2}$ and $1\frac{3}{4}$ years after the operations. In the first case the removed portion of the optic nerve measured 11 mm. and was sound throughout, while in the second case it measured 8 mm., of which the anterior 4 mm. were diseased.

E. G.

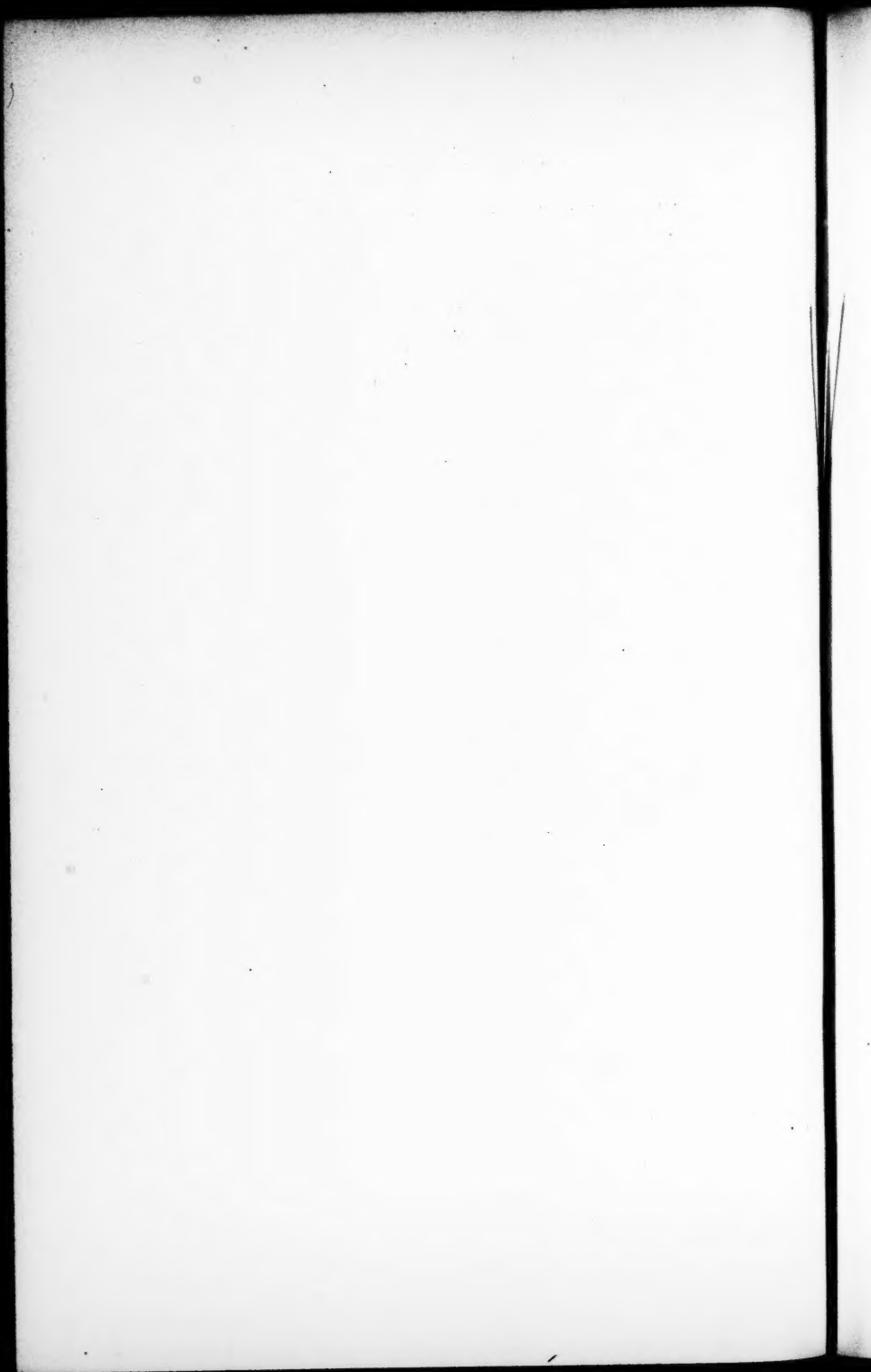
12. In the Clinical Society of London, MR. HUTCHINSON read notes of a case of intra-cranial aneurism diagnosed during life, and in which a spontaneous cure occurred. Mrs. S. came under his care in March, 1861. She was then forty years old. For ten years she had been subject to headaches. One year before coming under care these became much worse, and were attended by severe throbbing in one temple which sometimes lasted two or three days. About the same time her left eyelid drooped and vision became dim in that eye. These symptoms persisted. On admission there was on the left side complete paralysis of the external rectus, incomplete paralysis of the muscles supplied by the third nerve, and some loss of sensation of the left side of her forehead. The superior oblique was intact. There was no reason to suspect syphilis. An intracranial bruit was heard on auscultation of the heart. A few months later all branches of the third nerve became paralyzed, the fourth

still remaining perfect. There was some implication of all the sensory divisions of the fifth nerve, but none were completely paralyzed. The facial nerve was perfect. She remained during the succeeding ten years in much the same state, suffering at times from very severe internal headache, and during the early part of the time from throbbing. The fundus of the eye was normal, and the other eye and orbital nerves were healthy. Aneurism of the internal carotid was diagnosed by Mr. Hutchinson early in the case, and ligature of the carotid artery proposed, but deferred at the patient's urgent wish.

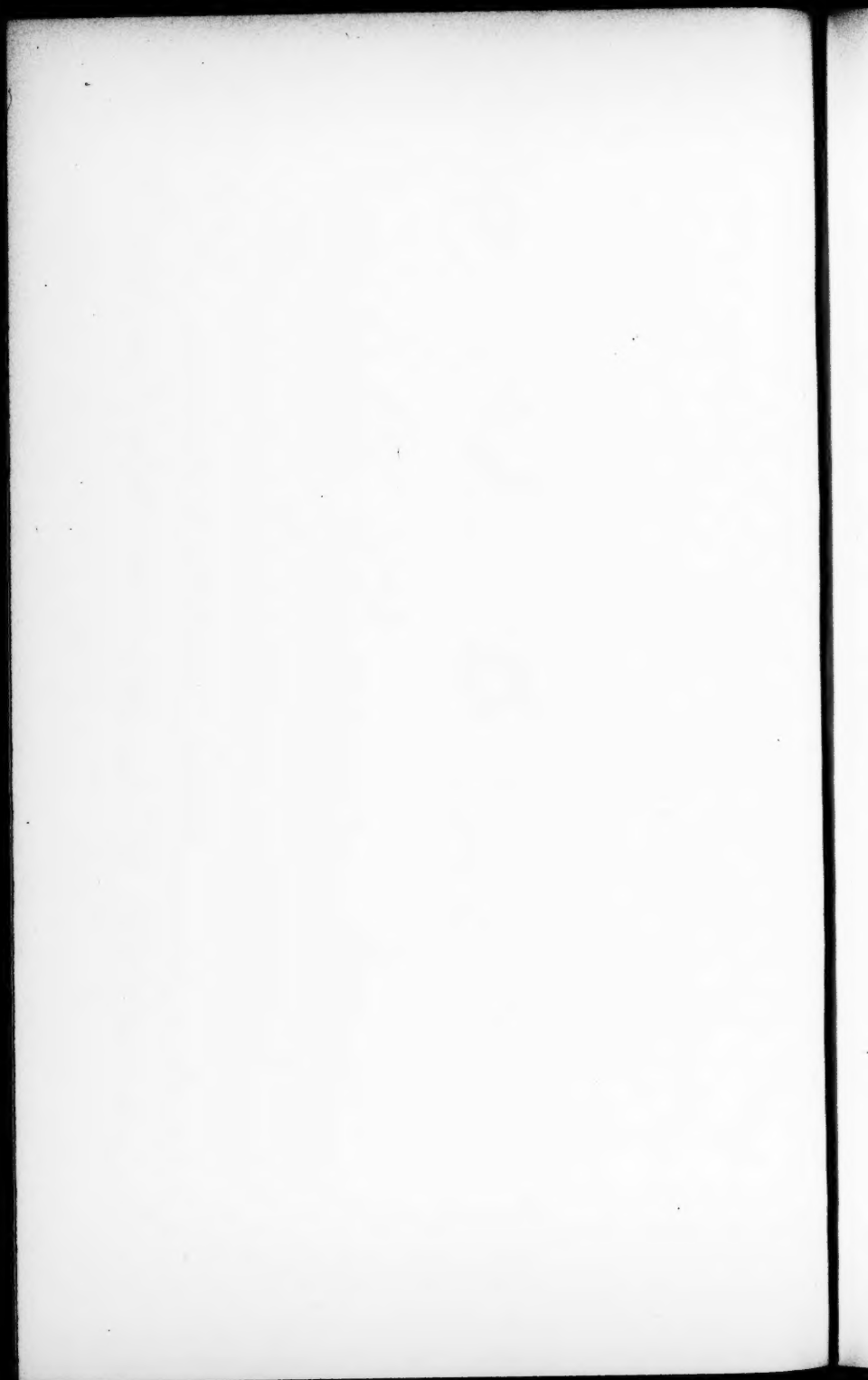
The throbbing slowly subsided, the paralysis remained, health improved, and the question of operation was abandoned. Vision of the eye remained tolerably good. In February, 1871, Mr. Hutchinson found a large pulsating tumor in the abdomen, which was diagnosed as aneurismal. Death occurred in May, 1872.

At the autopsy a solid aneurismal tumor of the size and shape of a bantam's egg was found at the inner part of the left middle fossa of the skull. The internal carotid passed along its inner side, and a well-defined smooth-edged aperture opened from the outer wall of the vessel into the sac; the distal branches of the artery were pervious. The optic nerve was in close apposition with the tumor, but exhibited no evidence of compression. The Casserian ganglion was situated directly beneath the tumor and flattened by it. The motor nerves of the eyeball were lost in the wall of the aneurism. The aneurism was nearly solid, the opening admitted a probe only to the depth of an eighth of an inch, its wall in great part calcified. A large dissecting aneurism of the aorta was found extending from the commencement of the thoracic part to the bifurcation of the abdominal portion.

E. G.



OTOLOGICAL PART.



ON THE ÆTIOLOGY AND DIAGNOSIS OF PHLEBITIS
OF THE CAVERNOUS SINUSES, AND THE VALUE
OF THE THERMOMETER IN THE DIAGNOSIS OF
CEREBRAL COMPLICATIONS OF PURULENT OTI-
TIS.

By R. WREDEN, OF ST. PETERSBURG.

(Translated by Dr. E. H. Bradford, of Boston.)

[With two Plates, marked Otol., Tab. I. and II.]

IN my article* on Phlebitis and Thrombosis of the cranial sinuses I gave, based on my own observations and those of others, the first exact description of the inflammation of the sinuses and discussed its differential diagnosis during life, that is, the distinction between affections of the sinuses of the base from those of the convexity and sides of the cranium. My statement (l. c., p. 128) that a diagnosis of phlebitis of the sinuses was possible, and would become easy to future observers, has been substantiated; since my first diagnosis, July 4th, 1869, several have been made by other observers.

Let me further mention, that although a number of authors have attempted before me a description of colpitis cerebialis (in my article a list of 105 papers, representing in all 151 cases), no one had examined colpitis cavernosa, although now the latter will be considered the most easily diagnosticated of the inflammations of the sinuses.† A new proof of the correctness

* Articles on Thrombosis et phlebitis sinuum duræ matris (St. Petersburg medicin. Zeitschr., 1869. Bd. XVII. p. 61, 137).

† Heineke (Chirurg. Krankh. d. Kopfes. in Pitha & Billroth's Handbuch d. allg. u. spec. Chirurgie, 1873, Bd. III., Abth. II., Lief. I., 2. Hälfte) who has given the newest description of phlebitis of the sinuses, says, among other things, "Important differences in the symptoms are derived from the situation of the inflammation. The inflammation of the cavernous sinuses gives the most characteristic symptoms." This is followed by an extract from my above-mentioned article on Colpitis Cavernosa, without mentioning my name or stating that I was not only the first to give an exact de-

of this view was given a short time ago by the following interesting case :

Ephrem Timofejeff, 22 years of age, cannoneer in the 2d Brigade Artillery, was received in the ear department of the hospital, with affection of both ears. Patient stated that he had had for a month a severe coryza, which affected the left nasal passage particularly, and lately had been accompanied by severe headache. He had gradually become worse, and an affection of the ears, first the right and then the left, with trouble of the left ear, had followed. Patient knew of no cause, said that the month previous he had been perfectly well.

The present condition was noted as follows :

Patient complained of severe localized pain in the left half of the forehead, of tenderness in left eye and the left nostril, which was entirely stopped; further, of impaired vision of left eye, of deafness and ringing in both ears, particularly the left, in which pain and discharge existed. No trouble in the thoracic or abdominal organs. No fever.

On examination the following was found :

Nose swollen from without, especially on the left side, and profuse discharge from both nostrils, the discharge from left slightly bloody. On the left eye, oedema of the eyelids, epiphora and photophobia, otherwise no inflammatory symptoms. Vision noticeably impaired. Right eye perfectly normal. Examination with the rhinoscopic mirror of Fränkel showed great swelling and redness of the mucous membrane on the left side, with excoriations in places on the septum and lower turbinated bone. I could not, however, discover a polyp; although

scription of thrombosis and phlebitis of the cavernous sinuses, but also the first to point out the necessity of a separation, pathologically, of the different cerebral sinuses. The passage in my article runs : "The cause of the little practical use of the present knowledge of inflammation and thrombosis of the cerebral sinuses is not, in my opinion, due to the nature of the disease, but to the unscientific use of the collected material. Authors hitherto have not properly considered in their descriptions of diseases of the sinuses two important facts. 1. The strict difference of thrombosis from phlebitis. 2. The pathological differences of the cerebral sinuses." Examples of the truth of the above follow (l. c., p. 69, 80). Heineke has accepted my view, for he describes (1) "The thrombosis of the sinuses of the dura mater" (l. c., p. 92, bis 96) separate from the "inflammation of the sinuses of the dura mater" (l. c., p. 96-102); and (2) separates the symptoms of the phlebitis of the sinus cavernosus from those of the sinus transversus and the sinus longitudinal superior, but he does not mention my name in connection with thrombus, and quotes me when describing phlebitis only in citing the literature, with this addition, in parenthesis, "Here is a complete list of the literature," and when discussing in the text Beck's case of inflammation of the sinus transversus, he adds, also in parenthesis, "Cited by Wreden, 18."

from the symptoms in the eye and nose I had considered the presence of one quite probable. There was also no obstruction to the introduction of the catheter into the left tuba.

Left Ear : A central perforation of the tympanum size of the head of a pin, apparently in cicatrization, as the inflammatory signs had almost entirely diminished and the discharge was very slight. Hearing (from the watch) $\frac{1}{2}$. Proc. mastoid. = —o.

Right Ear : External ear stopped with cerumen, after the removal of which the tympanum appeared slightly thickened and clouded, but no purulent inflammation and no perforation was noted. Hearing = 10', Proc. mastoid. = + O.

The tuning-fork was faintly heard before the left ear, but loudly when held before the right. Placed on the top of the head, and even on the left mastoid process, it was heard in the right ear louder than in the left.

Further, a larger infiltration of the sub-auricular lymphatic glands, which, according to the patient's statement, first appeared after the coryza.

Treatment : Internally, Inf. sennæ \mathfrak{z} iv., Potio Riveri, \mathfrak{z} ij., M. D. S. C. o. h. cochl. Externally : For the Nostril. Injection of warm salt water (\mathfrak{z} ss) and pencilling with a solution of zinci sulfur. gr. i., acid carbol. gr. ij., glycerine \mathfrak{z} i. For the ears : Injections of warm water and pencilling both ears with tinct. of iodine and astringent drops (zinci sulfur. gr. v., aq. dest. \mathfrak{z} i., for the left ear.

From the 15th to the 25th November, there was little noticeable change in the condition of the patient. The discharge from the nose diminished and lost its reddish color.

On the other hand, the condition of the right ear became worse, as a sub-acute perforating otitis media purulenta (a small round central perforation) developed, and the hearing sank to 4".

On the 25th November the pain in the forehead and the left eye increased. The left eye almost entirely blind. Pupil enlarged and reacting very slowly. Edema of eyelids and conjunctiva of the bulb. Moderate exophthalmus.

Gradual but uninterrupted deterioration.

Headache, loss of appetite, and weakness increased. Purulent discharge from both ears increased. Finally, on the 29th of November, fever with typhoid symptoms appeared.

Nov. 29th.— $\frac{M}{E}$ \mathfrak{z} ss. Pulse = 96. Skin and tongue dry. Pain in forehead very severe. Dizziness and nausea. Treatment : two leeches on the nose, and quinine internally, quiniæ mur. \mathfrak{z} s.; dil. muriat. acid \mathfrak{D} i.; aq. destil. \mathfrak{z} vi. M. D. S. \mathfrak{r} spoonful four times a day.

Nov. 30th.— \mathfrak{z} ss. Pulse 84. Passed a bad night.

Headache not diminished. Dizziness on raising the head. Retching after taking food and drink.

Skin and tongue dry. No chill or sweating. Treatment : continue quinine. Potus fructus citri. Injection of a weak solution of permanganate of potash in the nose and ears.

Dec. 1st.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse, 80, full. General condition unchanged. Tongue dry, with a brown coat on the side. Abdomen tympanitic. Treatment : Ol. ricini.

Dec. 2d.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 84. Headache less severe. Two watery dejections. Quinine continued.

Dec. 3d.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 84, full and hard. Marked weakness. Tongue dry and brown. Abdomen tympanitic, tenderness in both hypochondriac regions. Liver and spleen enlarged, the latter extremely so. Ilio-cæcal region not tender. Two watery stools. Congestion of the eye more marked than ever. Also œdematous swelling and redness of the skin of the left cheek, nose, and forehead. Mucous membrane of the cavum pharyngo-nasale and velum palatinum œdematous and reddened. In addition to the congestion of the blind eye, paralysis appeared of the oculo-motorius, trochlearis, and abducens (ptosis of upper eyelid, entire immobility of eye-ball, pupil dilated, not reacting). Ophthalmoscopic examination (Dr. Karsten) : Mechanical hyperæmia of the retina. Papilla not visible. Calibre of the artery normal. Otoscopic examination : profuse otorrhœa on both sides, that is, otitis media purulenta, with central perforation of the drumhead, the size of a pin's head, and great impairment of hearing. (The watch not heard, either if laid on the ear or on the head. Hearing for speech faint. Tuning-fork heard only with right ear, and only when placed on the head.)

In this condition I showed him to the class, and made the diagnosis : Phlebitis of the left sinus cavernosus from rhinitis (not from otitis, although a nasal polyp was not then visible).

Dec. 4th.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 80 ; bad night. Congestion and paralysis of the eye, and redness and swelling of the nose as yesterday. Emulsio oleosa (quinine stopped on account of the diarrhœa).

Dec. 5th.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 80. Sweating on previous evening. Headache less severe. General condition improved. Appetite improved. Patient answers well.

Dec. 6th.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 80, moderately full. Slept well. Two loose stools. Tongue dry. Appetite good. Pain in the forehead and over the eye continues ; also the blindness and immobility of eye.

Dec. 7th.— $\frac{3}{8}$ $\frac{3}{8}$ $\frac{3}{8}$. Pulse 80. Passed a bad night, although headache rather less severe. No loose dejection since yesterday. Otherwise as

yesterday. Muriate of quinine ordered. A solution of carbohc acid to be injected into the nose and ears.

Dec. 8th.— $\frac{3}{8}$ $\frac{1}{4}$. Pulse 80. A good night. Feels stronger, raises him self and turns in bed. Appetite good. A loose dejection, Headache continues. Eye no better. Quinine continued.

Dec. 9th.— $\frac{3}{8}$ $\frac{0}{4}$. Pulse 80. Patient says he feels better. Head freer, but still pain in the glabella and in the ears, which discharge copiously. Also severe ringing in the ears, and in the head. Discharge from the nose less. A polyp now seems to be visible in left nostril.

Dec. 10th.— $\frac{3}{8}$ $\frac{0}{4}$. Pulse 80. Headache not better. Otherwise no change.

Dec. 11th.— $\frac{3}{8}$ $\frac{1}{4}$. Pulse 80. No change.

Dec. 12th.— $\frac{3}{8}$ $\frac{0}{4}$. Pulse 80. No change.

Dec. 13th.— $\frac{3}{8}$ $\frac{1}{0}$. Pulse 72. Patient complains to-day of pain in the whole head and looks quite pale. In the left nostril, upper part, a dark red livid uneven polyp seen. Discharge from both ears increased, and the perforations larger. Hearing on the right side somewhat improved; on the left, markedly so. Right ear = $\frac{1}{2}$ ", Proc. mast. = O. Left ear S=4", Pr. m. = + Ktm > R. E. I did not undertake the operation for nasal polypus, notwithstanding the advice of the assistant physician, as the appearance of the patient and the infiltration of the glands of the neck made me suspect a malignant growth.

From the 14th to the 26th of December the patient was nearly without fever (*v.* Plate I.), went about the whole day and appeared convalescent. But I always looked upon him as a candidate for death, for besides the probable malignity of the nasal polyp, the symptoms of cerebral pressure were present, which pointed towards the formation of an abscess. The pulse was full and hard, but slow (56). The headache lasted, varying only in intensity. The localization of the headache always remained the same, *i.e.*, the left half of the forehead, over the left eye. The congestion of the eye and its surroundings (forehead, nose, and cheek) had entirely disappeared, but the paralysis of the orbital nerves remained. At times a slight improvement even in this respect appeared, as far as a slight mobility of the bulb and the iris. But these hardly noticeable improvements were always of a very short duration. On the other hand, the polyp grew very rapidly, since in two weeks it had filled the whole cavity of the left nostril, and already began to grow out. At the same time also, the condition of the ears gradually became worse again, that is, the discharge increased and the hearing became worse. (L. ear, = - o. Pr. m. = + o. R. ear = $\frac{1}{2}$. Pr. m. = + o. Ktm > R. E). After the 21st of December the patient became thinner, paler, and less

cheerful. Digestion slow. Appetite and sleep worse than in the beginning. Feebleness in the last three days increased, especially after an ounce of pure blood had been discharged from the left nostril on Dec. 26th.

In this condition the patient showed, on the morning of Dec. 27th, a temperature of 37.5° , and gave no signs of danger of immediate death. At 6 in the afternoon he was suddenly seized twice with vomiting at supper, immediately after which came chronic convulsions of the upper and lower extremities, opisthotonus, unconsciousness, and death in $2\frac{1}{2}$ hours. Temperature at 6 measured 39.0 .

This sudden and short agony I explained through bursting of the abscess.

AUTOPSY, 48 hours after death. The dura and the pia mater presented over the convexity, excepting a moderate œdema, no noteworthy alteration. Sinuses of the convexity and sides of the cranium normal. At the base of the brain, around the sella turcica, particularly in the left anterior fossa, was a circumscribed purulent meningitis. The left sinus cavernosus was inflamed and filled with ichorous fluid. Its walls and the surrounding connective tissue infiltrated (endo- and periphlebitis). The right sinus cavernosus and the two sinus petrosi superiores not inflamed. After stripping off the inflamed dura mater the lamina cribrosa ossis ethmoides was seen destroyed through the polypoid growth, which had made its way still farther backwards through the cellulae sphenoidales to the clivus Blumenbachii, and in this way destroyed the whole body of the os tribasilare with the exception of the ephippium, up to the synchondrosis sphenoidalis occipitalis. Further, the tumor had broken through the dura mater in the middle of the sella Turcica in front of the pituitary body, and a portion of the size of a pea projected directly into the cavity of the cranium. In front and below, the growth had spread in no small degree. The whole left nostril was filled, and a portion of the tumor projected; in addition, the upper part of the septum was destroyed through the constant pressure, and a portion of the growth had in this way entered the right nostril. Further, a portion of the inner orbital plate was destroyed. The whole of the cavity of the antrum of Highmore was filled by the tumor, which was adherent to the walls. The substance of the brain was œdematous. An enormous quantity of clear serous fluid in the ventricles, which, with the exception of the left lateral ventricle, were also filled at the anterior ends by a flaky purulent deposit. This latter came from an abscess, as large as a walnut, in the left anterior lobe, which had emptied itself by the cornu anterius into the lateral ventricle, and probably in this way caused the patient's sudden death. The abscess was without doubt of recent origin, as there were no indications

of its being encysted. Otherwise the brain and cerebellum were normal.

Thoracic and abdominal organs healthy, except the lungs, which were cedematous in the back and lower portion, and the liver, spleen, and kidneys, which were hyperæmic and much enlarged, particularly the kidneys.

The growth was larger than the size of a man's fist, dark red in color, in spots dark violet, of an uneven surface, soft and succulent, in gross appearance resembling the fungus hæmatodes of the older authors. Under the microscope it showed the characteristics of a round-celled sarcoma, with a large development of blood-vessels and collections of pigment in spots.

REMARKS.

In considering the above case, it is evident that we have to deal with a malignant growth, which in a short time—10 weeks—brought on the death of a young healthy man. The growth is to be classed as a soft sarcoma, usually noticeable for very rapid growth, and occurring frequently in young persons. At the autopsy it was impossible to state with certainty from which part the tumor took its origin. Its greater portion, to be sure, was in the left nostril, but also the whole of the os tribasillare was destroyed by the neoplasm, so that the latter lay directly under the dura mater from the crista galli to the synchondrosis spheno-occipitalis, and also had perforated the sella Turcica. Since sarcomata not unfrequently originate in the dura mater, the question suggests itself whether the neoplasm started from the base of the cranium, and, in time, gained the cavity of the nostril, or whether the reverse was the case? The clinical history is decidedly in favor of the latter assumption, as the disease began and ran during the first four weeks with the symptoms of a severe coryza, which caused no anxiety. It was not until the continuance of the coryza for a month, its getting worse instead of better, the prevalence of the disease on the left nostril, and the existence of unusual complications, such as a bloody discharge from the nose, external swelling of the left side, severe headache on the left side, the affection of the left eye and left ear, became manifest, that the suspicion of an unusual disease of the nose was awakened, and the patient sent by the regimental surgeon into

the hospital. The tumor must have its origin very high up in the nostril, either in the cells of the cribriform plate or from the concha superior ossis ethmoidei, as it was only visible three weeks before the death of the patient, although on his entrance into the hospital (Nov. 15), six weeks before his death, I had strongly suspected its existence from the clinical history, and had given myself the greatest pains, though to no purpose, to discover it. At that time the lower and middle nasal passages were entirely free from the tumor, as the examination with the rhinoscope and the catheter showed.

By rapid growth, characteristic of a sarcoma, the neoplasm must have filled the upper part of the left nostril, exerting a constantly increasing pressure on the thin bone plates, and finally destroying them. This partial destruction of the nasal bones through pressure was found at the autopsy in the upper part of the septum, that is, the lamina perpendicularis, the lamina cribrosa, the lamina papyracea of the ethmoid. The vena ophthalmica superior (interna) lies on the bony wall of the orbit which is formed by the lamina papyracea; this communicates anteriorly with the superficial branch of the vena facialis anterior (also with the venæ supraorbitalis, frontalis, angularis, nasalis, palpebrales super. et infer., and labialis superior) and passes posteriorly through the fiss. orbit. sup. into the sinus cavernosus. The gradually increasing compression of the vena ophthalmica which could not resist after the invasion of the tumor into the orbit, led finally to thrombosis of the V. ophthalmica the sinus cavernosus sinister, not from an inflammatory cause but a purely mechanical one, the obstruction to the course of the blood. This connection of disease of the sinus with an affection of the nose is in one respect of value, as it has heretofore never been noted.* At the time of the patient's entrance into the hospital, the following symptoms pointed to the existence of a thrombosis of the left sinus.

1. Congestion of the veins communicating with the sinus, that is, the venæ ophth. sup. and inf., the vena central. retinæ, etc., the œdematous swelling of the left nostril, forehead and eyelid, the mechanical hyperæmia of the retina, with diminution of sight,

* V. my "Article on Thrombosis and Phlebitis," etc., loc. cit., 104.

the swelling of the nasal mucous membrane and the bloody discharge.

2. Symptoms of collateral congestion in the course of the sinus petrosi inf. and sup., and the sinus transversus: left-sided deafness, ringing and pain in the ears. As the left ear showed the signs of a perforative inflammation of the middle ear, all the above symptoms could have been considered as caused by that alone, if the examination with the tuning-fork as well as the later course of ear affection had not pointed to a high degree of congestion in the labyrinth.

3. Indications of irritation of the first branch of the fifth pair which runs near the sinus cavernosus: sharp localized pain in the left half of the forehead and in the left eye (neuralgia n. supra-orbitalis), increased lachrymal secretion (irritation of the n. lacrymalis), and the photophobia (reflex irritation of the optic nerve).

These initial symptoms of thrombosis of the sinus developed more and more every day, increasing, in spite of all therapeutic measures, in intensity as well as extent. The gradual development of the paralysis of the cerebral nerves in the neighborhood of the sinus were particularly characteristic. Finally, in 14 days a group of symptoms had appeared, which indicated a higher degree of the affection in the sinus, the transition of the thrombosis into phlebitis, in consequence of the purulent infiltration and the dissolution of the thrombus. The symptoms of engorgement in the course of the vena ophthalmica were still more developed than at the entrance of the patient; œdema of the conjunctiva bulbi and slight exophthalmus (a result of œdema of the retro-bulbar tissue had appeared). The erysipelatous redness of the swollen skin of the nose and cheeks, indicated a phlebitis capillaris* in these particular parts. The collateral congestion in the sinus petrosi and transversus at this time not only declared itself on the left side, but also on the right, by the extreme deafness, that is, the interruption of the conduction of sound by the cranial bones. The œdematous swelling of the connective tissue around the vein of the left sinus was manifested

* V. my "Article on Thrombosis and Phlebitis of the sinuses of the dura mater" (I. c., p. 118. 119,) where I speak more fully of the value of erysipelatous swelling of the face in the differential diagnosis of phlebitis from thrombosis of the sinus cavernosus.

by the paralysis, from pressure, of the oculo-motorius and trochlearis nerves which pass over the outer and upper walls of the sinus, and by the irritation of the first branch of the fifth ; while the paralysis of the n. abducens (which passes through the sinus) showed great pressure within the left sinus cavernosus. The total blindness of the perfectly immovable eye also came from the pressure (resulting from inflammatory oedema along the tract of the optic nerve in the foramen opticum)* upon the n. opticus ; a stretching of the optic nerve sufficient to account for the blindness could not be caused by the slight degree of exophthalmus, nor could the venous congestion, discovered by the ophthalmoscopic examination, account for the total abolition of the retinal function.†

The occurrence of fever, of a typhoid character (Nov. 29th), with great enlargement of the spleen, in addition to the local signs, completed the picture of the phlebitis sinus cavernosi. This diagnosis, made four weeks before death, and carefully explained in a special lecture, Dec. 3, was fully confirmed by the further course of the disease and the autopsy.

The course of the sickness showed that all the congestive symptoms in the eye and the face disappeared entirely, in spite of rapid increase of the tumor, as a result of the opening of an ample collateral circulation, while the symptoms of pressure of the inflamed sinus on the neighboring cerebral nerves lasted till the end, and only improved slightly at times. Further, the changeable condition of the ears suggested collateral congestions in the neighboring sinus, and therefore deserves more careful attention.

Patient was received with a purulent inflammation of the left

* Compare my "article" etc., (l. c., p. 118-117 note).

† Note further the experiments of Sesemann (Reichert and Dubois, "Arch. f. Anat. and Physiol.," 1869, M. 2, p. 154), which have overthrown Gräfe's theory of "congestive papilla," that is, the neuro-retinitis symptomatica in cerebral affections, in so far as they prove that compression, that is, the obstruction of the sinus cavernosus or v. ophthalmica, can cause no marked congestion as long as the exit of blood into the vena facialis is not prevented. On the other hand, in favor of the strangulation of the n. opticus (in the foramen opticum, from the oedematous swelling of sheath), the researches of Schwalbe (Arch. f. Micr. Anat. Vol. vi. p. 1) prove the connection of the subvaginal lymph-space of the sheath of the optic nerve with the cavity of the arachnoid, and the possibility of intravaginal strangulation of the opticus through immoderate filling of the subvaginal space at its blind end, even when the pressure on the nerve in the foramen opticum is slight.

middle ear, and a catarrhal inflammation of the right, the existence of which is to be attributed to a continuation of the inflammation of the mucous membrane of the nose. The watch was heard on the right side 10" from the ear and when placed on the head, but on the left only $\frac{1}{2}$ " from the ear, and not at all when placed on the head. The tuning-fork from every point of the head sounded louder in the right ear. This result of the examination with the tuning-fork, and the abolition of the bone conduction on the left side, were arguments in favor of an extreme congestion in the left labyrinth. Ten days later, November 25, a perforative purulent inflammation of the middle ear on the right side had set in, by which the hearing fell from 10" to 4", but sound was still conducted by the bone. After eight days (Dec. 3), during which the phlebitis sinus cavernosi had developed, the collateral congestion spread to the right ear also, and the patient heard the watch in neither ear when the sound was conducted through the air or through the bone. The tuning-fork was very faintly heard through the bone and only by the right ear. Ten days later (Dec. 13), not only from the decrease in the swelling of skin, but also from the condition of the left ear, it was possible to discover the establishment of an ample collateral circulation. Patient heard with left ear better than on entrance into the hospital. The watch was again heard through the bone and at a distance of 4" from the ear, while on the right side the congestion of the labyrinth had diminished so much that the watch could be heard $\frac{1}{2}$ " from the ear, but not through the bone. This improvement of the hearing was the more remarkable, as the appearances of the local inflammation were worse. The perforations of the drumheads were larger. The putrid discharge was greater. There remained no other explanation for the improvement of hearing than the diminution of congestion in the labyrinth, so much the more probable, as three days later the conduction of sound through the bone reappeared on the right side too, without noticeable improvement in the appearances of the ear.

The last ten days of life, the discharge, in spite of all therapeutic means, increased in both ears, and the hearing sank again to 0 for the watch, but sound was conducted through the bone on both sides till death.

The examination with the tuning-fork gave the same result during the whole course of the disease, that is, the sound was always louder in the right than in the left ear—even on the day (Dec. 13) when the left ear heard better than the right, sound conducted both by air and by bone. An explanation of this condition can be sought only in the existence of an abscess in the left hemisphere.

When this abscess originated cannot be stated with certainty, though with probability. It was first diagnosticated by me two weeks before death (Dec. 14), as soon as the fixed circumscribed headache and the sinking of the pulse appeared. At the autopsy it was seen that the capsulation of the purulent collection had not yet begun, by which the short duration and the acute course of the inflammation are explained.

According to Lebert,* the capsulation occurs in the greatest number of cases between the 30th and 60th day of sickness. On the 29th day before the death of the patient, fever appeared, though he had been without fever the day before. An acute abscess of the brain, which led to the formation of a cavity of the size of a walnut, and to perforation into the ventricle, could not run its course without fever, at least without initial fever; hence, we are justified in the assumption, that in the above case the formation of the abscess had not lasted longer than twenty-nine days. The origin of the purulent encephalitis and the meningitis in the anterior lobe, is to be attributed to the neoplasm and not to the phlebitis of the sinus,† since in phlebitis of the sinus, as I have proved,‡ hemorrhages and inflammation of the meninges and brain occur as a result of direct congestion in the *middle*, and of collateral congestion in the *posterior* lobe and on the clivus Blumenbachii.

In the above case there was encephalitis and meningitis in the anterior cranial fossa only. They must therefore be considered not as a consecutive affection, but as a complication of the col-

* LEHBRET. Ueber Gehirnbräuse (Virchow's Arch. f. Path. Anat., etc., 1856. Bd. X. p. 100, etc.

† In my "Article," etc. (l. c. p. 103) I have expressed my ideas fully in opposition to Lehbret's view, that the colitis cerebri can serve as a conductor between caries and inflammation of the brain and meninges.

‡ See my "Article," etc. (l. c. p. 101).

pititis cavernosa, which probably arose at the same time, and added materially to the causes of the fever.

The fever, that is, the variation of the animal heat of the patient, which during the whole course of the disease was thermometrically determined at the morning and evening visits, *deserves* particular consideration, since it presents a peculiar course, as the accompanying thermographic plate (*v.* Otol. Tab. 1) shows. The morning and evening temperatures of the twenty-nine days during which the patient was under observation, exhibit a gradually increasing temperature in the first two weeks, and a nearly constant normal temperature in the last two weeks, with the exception of the first and last days when there was a rise of 1.5° . The fever begins and ends with a temperature of 39 , although on the preceding day the temperature was normal.

Besides this sudden initial and final rise of the animal heat, we find in all only five days when the temperature varied one degree, viz., on the fifth (1.0°), tenth (1.1°), sixteenth (0.7°), nineteenth (1.2°), and twenty-third (1.3°). The remaining twenty-two days show a variation of $\frac{1}{2}^{\circ}$ and less. On the whole, therefore, the fever was characterized by a continued course, and therefore made the co-existence of pyæmia which is frequent in colpitis cerebrealis, very improbable. The absence of the characteristic pyæmic chills during the whole sickness corresponded entirely to the course of a continued fever, which induced me, in connection with the other symptoms, to reject the idea of a pyæmia ex phlebitide sinus cavernosi. But the protracted course, or the duration for two weeks of the continued fever, pointed to a cerebral complication of sinus phlebitis. Whether this complication was a diffuse purulent basilar meningitis or encephalitis, I was unable to decide in the first two weeks. But when in the third week a retardation of the pulse from the pressure in the brain, with a complete absence of fever and a fixed pain in the left half of the forehead, were noticed, I decided in favor of encephalitis, and made the diagnosis of abscess in the left lobe. My colleagues, who had watched the case with me from the beginning, were not inclined to share my opinion, but thought the patient, who at that time was entirely free from fever, had a good appetite, slept well, and no longer kept his bed, was to be regarded as convalescent. Accordingly they urged me to operate on the polyp,

then becoming visible. I declined operating from reasons as above stated, and adhered to the prognosis of a fatal termination made on the fifth day of the fever (Lecture of December 3), in spite of all appearances of convalescence. In the following week (the fourth), my view gained ground among my colleagues, since the patient began to lose flesh rapidly, became fretful, his appetite and sleep were not so good, and after a light febrile attack (38.3°) on the 23d day of sickness, and a subfebrile evening temperature (37.8°), on the 24th his strength was failing rapidly. The confidence in the correctness of my diagnosis was much shaken by the fortnight of an apyretic condition of the patient. But when suddenly, on the 29th day, violent symptoms of cerebral irritation set in and were followed by death in two hours and a half I explained the agony by the bursting of the abscess into the lateral ventricle. There remained but little doubt of the truth of this view, and it was completely silenced at the autopsy.

On a more careful observation of the temperature curve, the following periods in the course of the cerebral complication fever can be noted in the above case:*

1. The initial period or pyrogenetic stage was very short, since on the the first day the temperature rose rapidly and without break, to a morning temperature of 39.0° , and gained in a few hours, that is, at 6 P.M. the maximum of 39.9° , which represented in this case the beginning of the fastigium, and also the acme of the fever. Such a sudden and rapid rise of temperature to a height of 39° - 40° and more, immediately on the first day, is peculiarly characteristic for the beginning of the fever of an encephalitic complication in purulent ear affections, as experience has taught me. The initial stage of the true colpitis cerebialis ex otitide, uncomplicated by cerebral or meningeal inflammation, is distinguished on the other hand by its slow development, long continuance, and shows usually not before the evening of the second or third day of the fever a temperature of *circa* 40° . Another valuable fact in the differential diagnosis of the initial period of the fever of encephalitic complications in

* A fuller explanation of my views on the fever in cerebral affections complicating purulent ear disease, of which I distinguish three thermometrically different forms—the colpitic, encephalitic, and meningitic—will soon be published in a larger paper.

inflammations of the ear is that it rarely begins with a chill, even when at its start, as I saw in one case, the temperature was 40.1° , whereas in the fever of colpitis cerebri and meningitis diffusa, usually if not always, the reverse is the case. These *two* facts, the sudden development of a high temperature on the first day, and the absence of a chill, alone justified the assumption that in the present case, in which the pathological appearances of a purulent colpitis, meningitis, and encephalitis occurred together, the fever was in the main caused by the encephalitic focus,—a view which the further course of the fever fully confirmed.

2. The fastigium of the fever, or the period of full development of the disease, began with the evening of the first day, when the temperature had reached its maximum, and lasted four days, during which the morning and evening temperatures varied constantly between 40° and 39° . The fact that the temperature remained so high in the first few days is sufficient to suggest in a case of purulent otitis the formation of an abscess in the brain, since in colpitis cerebri, or pyæmia, the fastigium is remarkable for the great variations of the temperature (1.5° to 2°), and reaches its full development at the end of the first or the beginning of the second week.*

The variation of the animal heat during this period deserves so much the more careful study as in other respects the affection presented few clear symptoms of an encephalitic fever, while the diagnosis of the inflammation of the sinus must be evident to every one from the above-mentioned symptoms of congestion and paralysis. At the beginning of fever the patient complained of an insupportable increase of the fixed circumscribed frontal headache on the left side, which was more severe at every motion of the body, or on any jar, and obliged him to keep motionless

* For comparison I have represented in Plate II. the temperature curve of a case of a typical colpitic form of cerebral fever, uncomplicated by encephalitis or meningitis. The patient fell sick on June 30, 1874, with phlebitis sinus transversus dextri (ex otitide), followed in a few days by metastatic inflammation of the joints, the pleura, the pericardium, and died from a fever of fifteen days' duration, with pronounced pyæmic symptoms. A glance at the fever chart makes it evident (1) that the initial period lasted three days, during which the temperature rose gradually; and (2) that the fastigium first attained full development between the sixth and eighth day, and was marked by great daily variations of temperature (to 2.1°). A fuller account of this instructive case will appear soon in the paper before mentioned.

on his back. Also a great weakness and dizziness, which made standing or walking impossible. Even raising the head in bed brought on dizziness and nausea. There was complete loss of appetite and sleeplessness, although the patient lay apparently somnolent, as if unconscious, with closed eyes, still and motionless, with a fever heat. But his intellect was unimpaired, as the clear and apt answers indicated ; a slight slowness, however, in the ideas, from the pressure in the brain, was unmistakable. Delirium was entirely wanting, even in the night. Skin and tongue dry. Drink taken willingly, but not asked for. Pulse full and hard—96 on the first day, in the following days 84 to 80 a minute. Respiration quiet. No chill or sweating. But during the fastigium, pain and tympanites of the abdomen, loose dejections (two to three daily), and great swelling of the spleen and liver, which symptoms, however, I think should be attributed to the phlebitis of the sinus.

3. The stadium amphibole of the fever or the period of variation, uncertainty in the course of the disease, lasted a week, and began with the fifth day, when for the first time a morning temperature was noted under 39° , viz., 38.0° , while the previous evening temperature had been 39.5° , and the following evening temperature was 39° . The fifth day brought the transition from the fastigium to the stadium amphibole, which from the sixth day on gave a constant variation of animal heat between 38.0° and 38.5° . On the evening of the sixth day (Dec. 4), sweating occurred, and as a result the evening temperature only rose to 38.2° , or only 0.2° higher than the morning temperature. The latter was remarkably constant, 38.0° five days out of seven, while the evening temperature gradually rose to 38.5° , but no higher, so that the daily difference was not more than $\frac{3}{10}$ to $\frac{5}{10}$ of a degree. Only on the tenth day (Dec. 8) was there a difference of 1.1° , occasioned by a sudden fall of morning temperature to 37.4° (the patient had had a good night) ; this must be regarded as a good prognostic symptom, as it showed a tendency toward a diminution of the fever, that is, toward recovery. In general, it can be said that the temperature in the stadium amphibole of the fever from a complicating cerebral affection usually marks a continued fever of seven days' duration, with slight daily fluctuations between 38.0° and 38.5° , which in rare instances only by a

rise or fall of 1° or 2° in the middle of the stage, allows a surmise as to what course the disease will take after the stadium amphibole. In the present case, on the thirteenth day of the disease, the stage of recovery, or stadium decrementi, began. This favorable turn could have been anticipated on the tenth day, as there was a fall on that day of the morning temperature to 37.4° , while the evening temperatures, or the daily maxima of the stadium amphibole, did not rise above 38.5° . On the other hand, sometimes in the middle of the stadium amphibole, with almost constant morning temperatures of 38° and lower, a sudden rise of the evening temperature to 39.7° will occur, which makes an unfavorable turn in the disease, or a transition from the stadium amphibole to the proagonic stage, very probable.

To make the state of the stadium amphibole clearer I have marked in red on the temperature chart of our patient* the course of the fever of another patient who also died from an abscess of the brain in four weeks. The abscess was situated in the right occipital lobe, and had burst into the posterior horn of the right lateral ventricle. There was no colpitis cerebrealis. But there was diffuse purulent basilar meningitis and purulent inflammation of all the ventricles. In both these patients the fever of the cerebral complication appeared on the same day, Nov. 29, 1873, and showed, to the end of the stadium amphibole, a similar cause: viz. a fastigium of five days between 39° and 40° , and a stadium amphibole of seven days between 38° and 38.5° , with this slight difference that in the first case the descending type prevailed and in the second the ascending. Corresponding to this we see on the 13th day in the first case a stadium decrementi of three days with following defervescence, or latency of the cerebral abscess, while in the latter on the same day a three-day stadium recudescentiæ was followed by a proagonic rise in temperature (41° morning), the result of the appearance of diffuse basilar meningitis. The general condition of the case under consideration varied during the stadium amphibole, corresponding to the temperature of the patient, in so far as there was, corresponding to the remission of the fever,

* The description and fuller explanation of this case will soon appear in the before mentioned paper on fever in the cerebral complications of purulent ear affections.

an improvement of the subjective symptoms, in which also the variations of the thermometer found their expression. With the beginning of sweating and the remission of the fever on the sixth day, the nausea and dizziness disappeared, the headache was less severe, sleep and appetite began to be better, though they were like the headache, one day better, another day worse. Marked improvement, noticed also by the patient, began first on the 10th day (fall of morning temperature to 37.4°). He felt freer in the head, and so much stronger that he could raise his body and turn in bed without help. Pulse during this stage 80 beats in the minute.

The period of recovery, or, more correctly, latency, since recovery did not take place in this case, began on the 13th day with

(4). The Stadium decrementi, when there was a continued though insufficient fall of the temperature for three days (11th, 12th, and 13th Dec.), and a noteworthy improvement in hearing, particularly in the left ear, though otherwise the patient's condition remained unchanged, that is, as in the second half of the stadium amphibole. On the 16th day

(5). Defervescence occurred, a great diminution of the patient's fever, beginning with an evening temperature of 37° , though on the day before it was 38° . For two weeks the temperature remained within the limits of normal human temperature, between 37.0° and 37.5° . In the middle of the first week (19th day, the morning temperature fell below the normal (36.3°), as in the convalescence of other febrile diseases. Patient left his bed and went about the whole day, ate and slept well. But the steady circumscribed headache remained, the condition of the left eye and ear was no better, the pulse was notably slower and the polyp grew very rapidly. If the neoplasm had not been present, the encysting of the abscess would have begun, and the period of latency might have lasted several months as I have frequently seen,* instead of two weeks. But the rapid growth of the sarcoma finally undermined the powers of the

* On Dec. 10, 1873, a few days before T.'s death, another patient (Sanitoroff) died in my ear-ward in the hospital of the Garde-à-cheval, after a fever of 16 days from a cerebral abscess (ex otitide) whom I had, in May of the same year, discharged in the stage of latency, after the fever from the cerebral complication had subsided.

patient and prevented a continued intermission of the encephalitic inflammation. Accordingly, we saw in the second week of latency, that is, the last week of life, a rapidly increasing emaciation, weakness and apathy, which gave the patient a cachectic appearance. At the same time, on the evenings of the first two days of the last week a febrile (38.3°) and subfebrile (37.8°) rise in the temperature appeared which I am inclined to explain by an advance of the cerebral affection towards the lateral ventricle or a preparatory inflammatory softening of the spot where the perforation finally occurred. The following five days showed again a perfectly normal condition in the temperature of the patient, who was able to walk about, till suddenly the violent agony appeared with an increase of temperature of 1.5° , that is to 39.0° . The explanation of his sudden death was easy, as I had two weeks before diagnosticated an abscess in the left frontal lobe. The fact is noteworthy that I made this diagnosis only in the apyretic period of the sickness, no doubt because, during the pyrexia, I was too much preoccupied by the characteristic objective symptoms of the colpitis cavernosa, and only when the whole course of the fever lay completed before me was I compelled from the temperature curve to recognize that here the encephalitic form of the cerebral complicating fever had prevailed over the meningitic and colpitic.

Accurate thermometrical observations of patients suffering from affections of the ear are, as this case teaches, of the greatest value and should never be overlooked. Unfortunately, thermometry in this field has not yet been cultivated, for which reason I felt justified in adding a few remarks to the description of the case here given.

ON THE OPERATIVE TREATMENT OF OTORRHŒA.

BY DR. OSCAR WOLF, OF FRANKFORT ON THE MAIN.

(Translated from the German by Dr. H. N. Spencer, of St. Louis, Mo.)

(With Four Woodcuts).

IN numerous cases of otorrhœa, both recent and chronic, we are satisfied from experience that the methods of treatment heretofore employed, namely, careful cleansing of the running ear with tepid water, inflation of the drum by the catheter or the air-bag, the application of various astringents, *e.g.*, solutions of lead, copper and nitrate of silver, and lastly cauterization with the bead of silver, mounted on a silver wire, have not proved adequate. The purulent discharge either persisted without interruption more or less copiously, or reappeared after temporary cessation.

The causes of the persistence of the otorrhœa are not always easily recognizable, since the point of suppuration is frequently concealed from our view on account of the conformation of the parts from the commencement of the osseous portion of the external meatus to the labyrinth wall of the cavity of the tympanum, or from contraction of the otoscopic field of inspection by swelling of the walls of the external auditory canal. Very often swelling and irritation have been induced by the continued application of astringents or the cautery to the sensitive cuticle of the meatus; or it might result from continued contact of fetid pus with the walls of the meatus.

In such cases, by careful cleansing of the suppurating ear with warm water, and using the precaution to protect the ear from unfavorable influences from without—with the employment of Politzer's method of inflation, or the catheter, as this case may be—we may in a comparatively short time be able to obtain, by recision of the swelling, a view of the seat of the disease, and most probably shall discover more or less extensive growths as the source and cause of the purulent process; it may be sim-

ple, soft granulations or more or less densely organized polypi. These growths arise exteriorly to the membrane as well as in the cavity of the tympanum, and spring either from the superficial tissues, the bone being unaffected, or are but a symptom of bone disease, covering that portion of the bone which has become carious and denuded of periosteum.

In a series of cases we have been able to recognize the origin and cause of these growths.

(1.) While it is known in the case of boils of the general cutaneous surface that the cavity which has been left after the expulsion of the core fills up with new granulations, which, on coming to the surface, under the influence of the air very soon shrink and form the cicatrix, observations have not been sufficient to determine this as the course in furuncles of the external meatus. New granulations of course occupy the cavity in the furuncle of the meatus as elsewhere, but here we find, either through the retention of pus, or by the exclusion of air on account of the swelling of the meatus walls, a more favorable condition for their continuance of life and further growth. Thus we have often the beginning of the formations of polypi.

(2.) Sometimes, as a sequence of diffuse external otitis, we have an exfoliation of the epidermis layer of the external auditory canal, forming a plug behind which exuberant granulations spring up, attaching by preference at the annulus tympanicus.

(3.) In continued acute purulent inflammation of the middle ear I have occasionally found towards the sixth or eighth week about the point of perforation of the membrane (which is most frequently in the anterior-inferior quadrant) formations, presenting the aspect of a hypertrophied mucous membrane. These should be removed in order that the perforation may close and cicatrization occur.

(4.) Finally, in suppurative inflammations of the middle ear, existing as a complication of constitutional affections, *e.g.*, scarlet fever, measles, typhoid fever, scrofula, or tubercles, in consequence of a sluggish circulation, small particles of bone may become necrotic, after which proliferous granulations will surround the point of diseased bone.

The method of treatment hitherto employed in these cases is as follows :

If there were found, after the swelling of the meatus has been reduced, large or small, dense or soft new formations, an attempt was made to remove them by means of the wire snare under illumination by direct or reflected light. This operation succeeds best and is to be recommended in the case of large polypi, which are not too deep-seated, and in those cases where the meatus is rather straight and wide. In the case of small growths, and such especially as are situated with broad attachment directly on the membrane, or which spring from the cavity through a small perforation, or in cases where the external meatus is strongly curved, the operator is often unable to succeed at all, or succeeds in removing a small portion only, while he inflicts very great pain upon the patient. In some cases where we can reach the pedicle of the formation, we may be able by cauterization with the silver bead to destroy the nourishing vessels and the growth. In a much larger number of cases, however, we shall be able only to touch the surface, and the cauterization, of course, would only act as an irritant, causing a more rapid growth. It should be said concerning the use of the caustic—which is painful in itself—that a very unpleasant complication may arise in extensive inflammation of the meatus, even to involving the auricle in an erysipelatous swelling.

These observations are confirmed by other aural surgeons (See Jos. Gruber, *Lehrbuch der Ohrenheilkunde*, p. 604, etc). I have not tried galvano-cautery, as recommended by Dr. Jacobi, of Breslau (see *Arch. f. Ohrenh.*, V. 1, and VI. 4), since the application of the sharp spoon, which I shall describe hereafter, yielded so satisfactory results that I could dispense with the—no doubt more difficult—use of the galvano-cautery.

In these cases, then, where the galvano-cautery, the wire snare, or the silver bead do not appear proper, or have not sufficed, and especially for the radical treatment of small carious spots and ulcers of the bone, the commencement of caries of the petrous portion, it must be said that we have not heretofore employed the proper course, nor possessed a suitable instrument. There has been, and there is to-day, as I shall go on to show, an unwarranted hesitancy in approaching these conditions, which should be met energetically. We diagnose off-hand, without having positive knowledge, an obstinate purulent inflammation of the

ear as caries of the petrous portion of the temporal bone, and regard it as a *noli me tangere*.

Possessing an accurate topographico-anatomical knowledge of the seat of the disease and its surroundings, and a skilful hand, it is undoubtedly safer to operate upon the growths which may be an obstruction to a free escape of pus, or if there is disease of the bone to treat it early in the manner which I am about to describe, than to look on composedly at the sure progress of the caries, leaving the patient helpless to the daily increasing danger of the entrance of pyæmia or meningitis.

An instrument suitable for operating in such cases, destined to be used by reflected light in a crooked canal, such as the meatus, must combine in itself different properties.

(1.) It must be so small that it will not obstruct the light in the deep meatus.

(2.) It must be malleable so that the cutting edge of the spoon can be bent in any direction; yet it must be firm enough for scraping the bone (as may be required in its use).

Such an instrument is represented in Figs. 1, 2, 3 and 4, (p. 98) in its natural size and in varied positions. It consists of a spoon having a slight concavity with a cutting edge and of a malleable shank of untempered steel mounted upon a small wooden handle. The instrument can be bent at any required angle to suit the location of the point to be operated upon. The spoon, of course, can be finished in different sizes according to necessity, and the shank can be made to have different degrees of hardness as may be required.

A view of the instrument almost suggests the manner of its employment.

It is more difficult to find the cause of a continued suppuration, which almost always has its foundation in granulation growths, than to remove the growth when once its pedicle and seat is known. After the ear to be operated upon has been carefully syringed out, and is well illuminated by means of the mirror fastened by the head-band to the forehead, we should try to obtain a view of the diseased spot by carefully removing the epidermis scales covering the parts, employing for this purpose a fine probe, and we seek at the same time for the pedicle and attachment of the polypus or the granulations. The instrument is then

prepared according to indications, and the cutting edge of the spoon is pressed against the root of the granulation with a slight

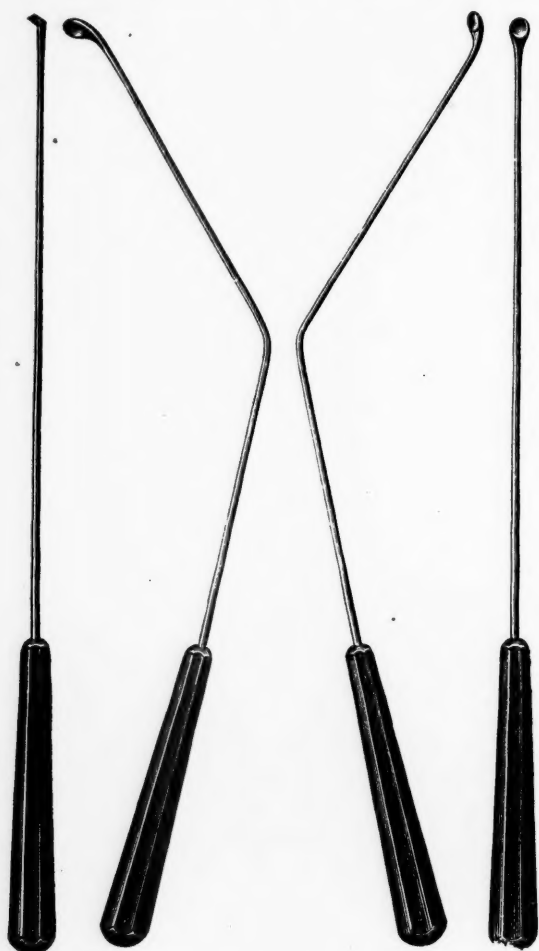


FIG. 4.

FIG. 1.

FIG. 2.

FIG. 3.

digging movement. If in the operation we do not detect any



distinct grating, as if the instrument came in contact with dead bone, we are satisfied with the removal of the granulations or polypus. If, on the other hand, we feel a rough surface of the bone and recognize, in the contents of the spoon when it is withdrawn, caries from the characteristic little black punctiform neurosed particles of bone, we proceed, after carefully cleansing the ear from blood, to apply the spoon once more and continue to scrape the carious surface until no more little black particles appear in the spoon.

Having in mind the topographical anatomy, and the instruments we have in hand, we are prepared to use the utmost care in the direction of the roof of the cavity where we are brought so close to the dura mater. In every other direction we may proceed without likelihood of danger—indeed without fear of reaction, as over all the petrous portion of the bone there is so great thickness that there is no injury that can likely be done to neighboring parts, at least to those accessible to the instrument. The carotid artery lies too deep. There is no danger in the direction of the mastoid cells. On the upper portion of the annulus tympanicus we have to take into account the course of the chorda tympani, injury of which would abolish the acute taste of the corresponding side of the point of the tongue for a longer or shorter time.

The operation is so quickly ended and the pain attending it with a skilful employment of the instrument, is so slight that it appears scarcely necessary to anæsthetize an intelligent patient. Unruly children and very timid sensitive adults, for the safety of the operation, are always best placed under slight narcosis. Having in the manner described scraped well the carious points of the bone and having cleansed the ear very cautiously (the syringing is somewhat painful after the operation), the meatus should be closed with clean lint, which should be changed frequently, and the patient should be kept quietly in the house. No material reaction ever follows the operation. The results of the operation at my hands after a year and a half employment of it have been favorable. The cases in which the removal of the granulations did not discover caries, proceeded rapidly to heal with *restitutio ad integrum*.

Where caries existed, several sittings were often necessary for scraping the bone.



Naturally there should be a rest of four to eight days between the sittings, in order to ascertain if the healing process will not follow and cicatrization occur.

In severer cases of deeper disease of the bone, of course, healing could not take place—we may only effect a diminution in the fetid secretion. The improvement of the hearing depends upon the seat of the removed growth, if it has encroached upon the vibratory apparatus, which is essential to hearing the improvement momentary upon the operation is very striking. If the growth has offered no essential obstruction there will result a considerable improvement in the hearing—increasing with the declension of the suppuration and the consequent subsidence of the swelling of the mucous lining of the cavity of the tympanum.

If we cannot always determine from the peculiar seat of the necrosis as to its cause and the likelihood of its extension to the brain, we may judge from symptoms if such a complication is threatening—in such a case the patient complains early of frequent sensations of heaviness in the head, of headache, dizziness, and vomiting, and such symptoms should forcibly interdict the performance of the operation which might be attended with an immediate fatal result, or cause it to follow speedily, to our mortification and reproach. In such cases we should content ourselves with removing cautiously with the snare the larger growths which might obstruct the exit of pus. Such patients may live for a number of years, experiencing little inconvenience until once there is an encroachment of the process upon the meninges, and then inevitably a fatal result must follow.

A less frequent cause why a suppuration of the ear, notwithstanding careful and persistent treatment, does not yield, is found in the commencement of cicatrizations and adhesions in the cavity of the tympanum. Such cases, upon inspection, show the characteristic retraction of the membranes and deep cicatrices before or behind the handle of the hammer, which is sometimes bound to the opposite wall of the promontory. The air-douche inflates the cavity at most only imperfectly—the cicatrices not changing position—the membrana tympani remaining immobile, the handle of the hammer foreshortened perspectively. Often drops of thick pus are forced through. The hearing is influenced unfavorably by the gradually progressing rigidity in

the articulation of the ossicles, and in consequence of the continued abnormal pressure exercised upon the fluid of the labyrinth.

The division of the cicatrices and adhesions by means of the little instrument (see Fig. 4), has given me good results as respects the hearing and control of the suppuration where the cases have not been too long standing, and the ossicles have not yet become rigid. This instrument, made also with a malleable shank, has its blade at an obtuse angle with the axis of the handle, and is sharp upon three sides. The operation is absolutely unattended with danger and rarely ever produces inflammatory reaction.

I can earnestly recommend these operations to my colleagues.

I hope in a short time to be able to publish some of the results which I have obtained.

THE CONNECTION BETWEEN EPILEPTIFORM PHENOMENA AND DISEASES OF THE EAR.*

BY DR. MOOS.

(Translated by Charles H. Burnett, M.A., M.D., Aural Surgeon to the Presbyterian Hospital in Philadelphia.)

THE diseases of the brain, its appendices and coverings as well as the nerves which it sends to the periphery, so far at least as they occur as complications in diseases of the organ of hearing, may be divided into two groups :

In the *first* group may be placed those diseases of the brain, etc., which are to be regarded as the result of a direct passage to it of an inflammatory process, whether they are brought about by certain anatomical predispositions, as, for example, through smaller or larger osseous canals, which are present in the normal condition of the bone, or through natural perforations in its substance, the so-called dehiscences, or through carious openings, etc. All such complications have nothing, in the main, very striking, and therefore we shall not consider them at this time.

In the *second* group we may place all those disturbances in which we are forced to suppose, according to the present status of nerve-pathology, that certain conditions of irritation in the external, middle, or internal ear are conveyed centripetally by means of the nerves distributed to them, to the brain, and there produce processes which are manifested again peripherically, in the most varied clinical forms, modified by the smaller or larger group of nerves, by which the original irritation was conveyed to the cerebral centre :

These may be called simply *reflex-neuroses*.

Originally, long before the designation reflex-neuroses was generally accepted, both recognition and description were given to those disturbances which are produced by irritative conditions in

* A lecture delivered on May 1st, 1875, at Heppenheim, before the Society of Alienists of South-western Germany.

the external auditory canal, as, for example, those which are the result of foreign bodies from without, of sequestra which have worked their way from the temporal bone, and have at last become wedged in the external auditory canal, or of new formations in close contact with the walls of the auditory canal. These reflex disturbances consisted in attacks of sneezing, coughing, vomiting, etc., which were always correctly referred to the irritative presence of a foreign body in the external auditory canal, first, because their occurrence could easily be explained on anatomical and physiological grounds, based upon the distribution of branches of the vagus and trigeminus to the external auditory canal; and secondly, because all these attacks ceased, even after lasting for years, after the removal of the foreign body from the auditory canal.

An examination of the literature of published cases shows that we can arrange the complicated reflex disturbances which occur in certain diseases of the ear, in three classes, viz. : Reflex epilepsy, reflex hemiplegia, which often occur together, and reflex psychoses.

To the cases of reflex epilepsy belongs that of Fabricius Hil-danus,* which furnishes a case of simultaneous atrophy of one arm, and anæsthesia of one-half of the body. Recovery followed the removal of a glass-ball from the external auditory canal, where it had reposed eight years.

A similar case is given by the Scotch physician, MacLagan.† Other cases of partly epileptic and partly tetanic attacks, resulting from inflammatory diseases of the ear, and disappearing upon cure of the aural disease, have been published by Hughlings Jackson,‡ and by Köppe and Schwartze.§ I || published, too, twelve years ago, a case of epileptiform and tetanic attacks occurring in a

* v. Troeltsch's Lehrbuch, p. 38.

† Wilde, Diseases of the Ear.

‡ Epileptic or Epileptiform Seizures, occurring with Discharge from the Ear, *Brit. Med. Journ.*, June 26, 1869. I know this case only from a quotation by H. Knapp (*these Archives*, Vol. II., No. 1, p. 264), and do not know whether it ended also in recovery.

§ Two Cases of Reflex Epilepsy from Disease of the Ear, *Arch. f. Ohrenh.* VI., p. 282.

|| Verhandlungen des Heidelberger Naturhistorisch. Medicin. Vereins, Bd. II., p. 218, and Klinik der Ohrenkrankheiten, p. 239.

patient suffering from purulent inflammation and caries of the ear. But the attacks have ceased only subsequent to the publication of this case.

Hillairet,* and Handfield Jones † saw, as a result of the presence of insects in the external auditory canal, epilepsy with hemiplegia, which attacks, by the removal of the insects and the irritation in the external auditory canal, were either instantly cured or very soon ceased.

Very recently Köppe ‡ published accounts of two cases of psychoses, which he very correctly has termed reflex psychoses, and which he completely cured by attention to and treatment of the disease of the ear, which was present.

In addition to this short review of the literature of the subject, which makes no pretention to completeness, I take the liberty of communicating to you the account of a case of reflex epilepsy, resulting from disease of the ear, observed by me last year.

Wilhelm Halter, 8 years old, from Rohrbach, was for the first time brought on the 14th July, 1874, by his mother, to the clinic for ear-patients. It was stated that the patient had suffered from time to time, for two years, with earache and aural discharges; the hearing had become greatly reduced, and his mother admitted, upon being questioned, that the deafness had probably lasted for a long time. The following history was carefully obtained :

Every month or two the patient had suffered with earache on the right side, which had always ceased after a purulent discharge was established, and sometimes stopped without any discharge.

Very often these attacks of earache lasted as long as 8 days, day and night. In the interim, every three or four weeks, the patient had attacks of unconsciousness, which were ushered in regularly with great sleepiness and great diminution of the hearing, and sometimes vertigo, headache, and palpitation of the heart.

These attacks of unconsciousness lasted from 2-3 hours, during

* *Gaz. des Hôp*, 1860, No. 23.

† *Lancet*, II., 25, 1863. *Schmidt's Jahrb.*, 1864, No. 11. Bericht über Reflex-hemiplegie von Thomas Palmer.

‡ *Reflexpsychosen nach Ohrenkrankheiten*, *Arch. f. Ohrenh.*, IX., p. 220.

which the patient did not fall, and had no convulsions, but remained unconscious and speechless, his gaze being fixed.

The still greater diminution of hearing was so marked in the later stage of the disease, that when it occurred the relatives of the child predicted one of the attacks just described with invariable certainty. The attacks disappeared with vomiting, and then consciousness returned. It was further ascertained that the patient's brother, a lad fourteen years old, with normal hearing, was dull-witted, and that a brother of the mother had had the "falling disease" (epilepsy), but died at 28 with consumption.

The objective examination gave the following :

On both sides the membranæ tympanorum were considerably drawn in, and they appeared tightly stretched over the promontory. The short process of the hammer and the posterior fold of the membrana tympani were sharply prominent, and the manubrium appeared perspectively foreshortened.

These appearances indicated a long-continued closure of the Eustachian tube, which, by cutting off the ordinary supply of air from the tympanic cavity, caused a part of the air contained in the drum to be absorbed, while the remaining part was rarefied, so that the usual atmospheric pressure within the drum-cavity ceased while the pressure of the air without remained the same. Hence the membrana tympani and the chain of auditory ossicles were forced inward, the entire sound-conducting apparatus more stretched, and in consequence of its diminished vibratility, and the increased pressure in the labyrinth, a frequently enormous diminution in hearing was brought about.

In fact, at the first visit, intense hardness of hearing was discovered on both sides.

Speech was understood on the right side only 4 ft., on the left only 2 ft. A watch, heard normally 12 ft., was heard on the right side 3 in., and on the left, 1 in.

Further examination revealed an excessive catarrhal disease of the nares and naso-pharyngeal space, which was probably the origin of the entire disease.

The treatment, until the 20th Feb., 1875, consisted in the use of Weber's nasal douche (also called Thudichum's, T.), and at times inflation of the middle ears, by means of which entrance was effected to left tympanic cavity, but on the right side it was neces-

sary to perform paracentesis of the membrana tympani on 10th Oct., 1874, and 16th February, 1875, as on both occasions it was impossible to render the Eustachian tube pervious.

Since the beginning of the treatment, on the 14th July, 1874, until 20th February, 1875, there was no earache, nor were there any of the epileptiform attacks. I saw the patient, for the last time on 17th April. Hearing was almost normal. There were no more epileptiform attacks, although all treatment ceased after 20th February, 1875. All these statements were corroborated by the mother on 27th April.

From the above history, it is very evident that the patient was affected by a twofold disease, firstly, by a catarrhal affection of the naso-pharyngeal space and the middle ear, which arose to a painful inflammation in the tympanic cavity, every four or eight weeks; and

Secondly, he was subject to attacks, which we may term, briefly, *epileptic*.

The prodromes of these attacks consisted in an increase of the hardness of hearing, in regular onset of sleepiness, in occasional palpitation of the heart, headache and vertigo, and the attacks themselves were characterized by fixed gaze, speechlessness and unconsciousness for 2-3 hours, terminating regularly in a return of consciousness, with vomiting.

The vertigo and vomiting in this case are not to be considered as symptoms of epilepsy, but are wholly due to the aural disease, for it is very plain that by the unilateral pressure upon the membrana tympani and ossicles of hearing, the pressure in the labyrinth was increased, which, by being conveyed to the epi-cerebral space, very often produces vertigo and vomiting.

Having accounted in this way, however, for the vertigo and vomiting, there still remains a set of symptoms which, although there was an absence of convulsions, must be called *epileptiform*, or *epilepsia incompleta*.

As the attacks ceased after a purely local treatment, and have not reappeared after a lapse of about nine months, the *post hoc* must be admitted to be *propter* in this case, and, consequently, we are justified in supposing that in this instance there was an intimate connection between the disease of the ear and the epileptiform symptoms. The next step should be an explanation of this connection.

The starting-point of the disease I find in the inflammation of the tympanic cavity ; this inflammation brought about a condition of irritation of the tympanic plexus ; this condition of irritation communicated itself to the brain, and produced there the described attacks, favored by the hereditary tendency already mentioned.

While I offer this explanation, I also wish to say that I shall be very thankful to any one of you who can offer a better solution, and I shall also gladly adopt any better way of explaining the case. But if you do agree with me, you will also see the significance of the facts in this case, and its importance, not only for neuro-pathologists, but for the physician interested in diseases of children. For inflammatory affections of the drum-cavity occur very often in childhood, and we also know that many cases of convulsions in children cannot be explained. Further observations will show whether we are not, in many instances, justified in ascribing these to a disease of the ear.

THE USE OF THE MEMBRANA TYMPANI AS A PHONAUTOGRAPH AND LOGOGRAPH.

By CLARENCE J. BLAKE, M.D., BOSTON.

(With a heliotype plate : Otol. Tab. III.)

THE various forms of instruments constructed for the purpose of obtaining tracings of sound-waves, and to which the name of phonautograph has been given, differ but little in their mechanism, and consist principally of a resonator, or mouth-piece, open at each end, the smaller opening being closed by a membrane to which is attached a pen or style by means of which the vibrations of the membrane are traced upon smoked glass or prepared paper, moving at right angles to the direction of excursion of the style, the movement being effected either by drawing the plate horizontally or by fastening the prepared paper to a revolving drum.

The first instrument constructed by Scott * consisted of a hollow ellipsoid. The sound-producing body was placed in one focus of the ellipsoid, while the membrane was stretched at the other focus. König improved this instrument by giving it the form of a paraboloid and constructed it of metal; various improvements were also made in the manner of setting the membrane, which in the later instrument is so arranged that, by means of set screws, the metallic ring which holds it may be placed at different angles of inclination to the long axis of the mouth-piece, and its tension increased or diminished at will. The manner of attachment of the style has also undergone several variations, the latest improvement being that of Mr. Morey, of the Massachusetts Institute of Technology, who attaches a style made of light wood to the periphery of the membrane by means of a strip of gold-beater's skin; contact with the membrane being effected by means of a short rod, also of light wood, attached to the style and resting upon the centre of the membrane. The

* Report of the British Association, 1859. Pisko, Die neueren Apparate der Akustik, 1865.

style or arm projects a distance of a foot or more beyond the periphery of the membrane, and has at its end a strip of metal which makes a tracing upon a plate of smoked glass drawn horizontally at right angles to the direction of excursion of the style.

The membranes employed in these instruments have been either thin bladders, gold-beater's skin, thin rubber cloth, or even parchment paper and collodion film; the gold-beater's skin has generally best answered the purpose, is easily prepared and readily obtained.

The experiments made by Bourget and Bernard,* Marx,† and especially by Donders‡ and by later observers, show that, under the same circumstances, that is, with the same tension of the membrane and the same length and weight of the style, each sound produces its distinctive curve. Various tone colors possess various curves, and each individual tone has its corresponding compound curve. Each vowel sound has a corresponding curve, the curves produced by *u*, *ue* and *i* being very nearly the same. The form of the curve, however, changes with the pitch of the vowel.

In sounding the diphthongs, the duration and form of the transition from one vowel to the other is distinguishable in the tracing. Consonants sounded before the vowel change the form of only the first part of the tracing, sounded after the vowel of only the last part of the tracing.§ The experiments made with the membrana tympani used as a phonautographic membrane, substantially confirm the above observations as stated by Donders, with this advantage, that the far greater delicacy of the means employed in experiment have made it possible to detect minute variations in the forms of the curves; in the tracings thus obtained, for instance, the difference between the corresponding curves of *u*, *ue* and *i* are made more marked. The differences consequent on changes in pitch and on varying degrees of tension show more plainly in the almost microscopic tracings obtained from the

* Sur les vibrations des membranes carrées.

† Studien ueber die Schwingungen der Membranen. Bindseil's Akustik.

‡ Zur Klangfarbe der Vocale. Pogg. Ann. 1864. Pisko. Neueren Apparate der Akustik.

§ Donders, loc. cit.

membrana tympani than in the tracings made by the coarser mechanical device of the mechanician.

The desire to obtain a more delicate instrument led to a series of tests with various membranes, and finally to the use of the human membrana tympani and to the experiments the results of which are to be given in further communications.

It is readily comprehended that a structure so admirably fitted by nature for the office which it has to fulfill, the reception and transmission of sonorous vibrations, should better answer the purposes of experimentation than any merely mechanical device. The accompanying structures, also the malleus and incus with their attachments, may be made available in the adaptation of the organ to its mechanical uses. The proportionate distribution of the weight of these bones, as shown in a previous paper,* is such as to constitute a counterbalance, as it were, to the larger proportion of weight lying above the axial line of vibration of the malleus and incus, thus favoring the vibration of the membrana tympani under certain conditions of tension, and enabling it to transmit more readily the delicate impulses of the shorter sound-waves corresponding to the higher musical tones.

The membranes employed in these experiments have been preferably those of the human subject, as being most readily obtainable under favorable conditions, as presenting the greatest delicacy of structure and of adaptability to the purpose, and as affording opportunity also for the study of the method of transmission of sonorous vibrations in addition to the purpose of merely obtaining tracings similar to those obtained from the mechanical membrane phonautograph.

In preparing the membrane tympani for use, a specimen as nearly normal as possible is obtained, the temporal bone removed and cleaned, the auricle and other soft parts removed, and the lining of the external auditory canal cut away to a line close to the membrana tympani.

The tegumentum tympani is then cut away by means of a bone-chisel, great care being taken to avoid disturbing the ossicula. The opening should be sufficiently large to permit a clear view of

* Mechanical Value of the Distribution of Weight in the Ossicula. C. J. Blake. Trans. Am. Otological Society, 1874.

the cavity from the antrum mastoideum posteriorly to the opening of the Eustachian tube anteriorly, uncovering the malleus and incus, and extending inward so far as to reveal the inner tympanic wall and the articulation of the incus and stapes.

This latter articulation is then divided by means of a narrow-bladed knife or paracentesis needle, and the musculus tensor tympani also cut across close to the insertion of its tendon on the malleus; or, if it be desirable to retain this muscle for experiment, in which it may be used for traction to increase the tension of the membrana tympani, its belly is dissected out from the bony canal in which it is lodged. A section is then made from behind forward through the tympanic cavity, separating the petrous from the mastoid and squamous portions of the temporal bone, a hair-saw being used for this purpose and carried between the incus and stapes through the divided articulation.

At this point the saw should be inclined inward toward the stapes, and the descending process of the incus pressed gently outward by means of a spatula, in order to avoid any movement of the incus, a touch of the saw upon the bony process of the incus being often sufficient to rupture the capsular ligament of the articulation of the malleus and incus, and so far derange the relations of the ossicula as to render the specimen unfit for experiment. The petrous portion of the temporal bone with the stapes having been removed by this section, the inner surface of the membrana tympani is freely exposed with the malleus and incus in position. The outer portion of the floor of the tympanum is then removed with a file or the Rüdinger knife, and the specimen cleaned of the small pieces of bone and the bone dust which would otherwise load the membrana tympani and interfere with its vibration or obstruct the movements of the ossicula. As the specimen becomes dry it is moistened with a mixture of equal parts of glycerine and water. To obtain tracings of the sound-waves conveyed to the membrana tympani, it is necessary that the specimen be firmly fixed, that a style should be attached to the membrane, and that a plate, upon which the movements of the style are to be traced, should be carried smoothly and at a uniform speed in a direction at a right angle to the direction of the excursion of the style. For this purpose the specimen is attached, by means of thumb-screws passing through holes bored

in the squamous portion of the bone, or by means of a clamp, to a perpendicular bar sliding in an upright and moved by a ratchet-wheel. (See Otol. Tab. III.) To the upright is affixed horizontally a metallic stage having a glass bed six inches in length, upon which slides a glass carriage carrying a glass plate. The carriage is drawn by a weight on the end of a cord passing over a wheel at the end of the stage and attached to the carriage. A flexible bell-shaped mouth-piece, or a conversation tube, is inserted in the external auditory meatus and luted in position. A musical tone sounded in the bell or mouth-piece being conveyed to the membrana tympani, will set it in corresponding vibration.

These vibrations may be observed by means of a light ray thrown upon small specula made of foil attached to the malleus, incus, or different parts of the membrana tympani, or may be recorded by a style tracing upon the smoked glass plate resting upon the carriage.

The character of the style is a matter of considerable importance; it should be very light and firm, and sufficiently elastic to bend easily when its point is pressed upon the glass plate, and should be so stiff as to have but little vibration of its own. After a series of unsuccessful, or but partially successful attempts made with styles of horse-hair, bristles, cane fibres, split bamboo and the like, the best style for the purpose was obtained by splitting long wheat straw, scraping the inner cortical substance away, and separating single fibres; these could be obtained of any desired length, and so far have answered all that has been required of them.

A style of this sort is fastened to the descending process of the malleus or incus by means of glue or pitch, in a line with the long axis of the process and extending downward for a distance of from half an inch to an inch, according to the size of the specimen and weight of the style, and inclined slightly toward the direction in which the carriage moves. The plate of glass, smoked evenly over an ordinary oil lamp, and attached to the carriage by metallic springs, is placed in position under the style, the point of which is brought lightly in contact with the surface of the plate by adjustment with the ratchet-wheel.

The membrana tympani being set in vibration, and the carriage, drawn by its weight, moving at a right angle to the ex-

cursion of the style, a wave line, corresponding to the character and pitch of the musical tone sounded into the ear, is traced upon the smoked glass.

For preservation, the plate is then floated with varnish and allowed to dry and harden. In conducting the experiments with this apparatus, I am greatly indebted to the advice and co-operation of Prof. A. Graham Bell, of this city, who has also availed himself of this means in his investigations of the manner in which articulate sounds are produced.

The advantages in using the membrana tympani for the purpose of obtaining phonautograms are evident upon comparison with the various mechanical devices for accomplishing the same purpose, and a consideration of its structure gives sufficient evidence of its adaptability as an instrument for the purpose of recording the vibrations of a wide range of musical tones of varying character.

OTOLOGICAL REVIEW.

By CLARENCE J. BLAKE, OF BOSTON.

1. C. UTZ. Beitrag zur Histologie der häutigen Bogengänge des menschlichen Labyrinths. E. Stahl, München, 1875.
 2. E. ZUCKERKANDL. Anatomische Notiz über die Tuba Eustachiana eines Elephas Indicus. *Monatschr. für Ohrenheilk.*, Sept., 1875.
 3. N. RÜDINGER. Die Fossa jugularis und ihre individuelle Grössenverschiedenheit. *Monatschr. für Ohrenheilk.*, Jan., 1875.
 4. T. DWIGHT. Seventh Semi-Annual Report on Progress in Anatomy. *Boston Med. and Surg. Journal*.
 5. C. NICOLADONI. Beobachtung am Lebenden über die Bewegung der Tuba Eustachii. *Monatschr. für Ohrenheilk.*, Aug., 1875.
 6. C. MICHEL. Neue Beobachtungen über das Verhalten der Rachenmündung der Tuba und über die Thätigkeit der Muskulatur des Schlundkopfes. *Berliner Klin. Wochenschrift.*, Oct., 1875.
 7. J. BERNSTEIN. Les Sens. Bibliothèque Scientifique Internationale. Baillière, Paris, 1876.
 8. GEORGE P. FIELD. Tinnitus Aurium. Henry Renshaw, London, 1875.
 9. SAMUEL THEOBALD. Tinnitus Aurium. Innes & Company, Baltimore, 1875.
 10. JOSEF GRUBER. Ueber ein neues Verfahren zur Wegsammachung der Eustachischen Ohrtrumpete. *Genossenschafts-Buchdruckerei*, Wien, 1875.
 11. H. B. HEWETSON. Rupture of the Right Membrana Tympani during an Attack of Vomiting. *London Lancet*, Sept., 1875.
 12. GEORGE P. FIELD. A New Form of Artificial Membrana Tympani. *British Med. Journal*, June, 1875.
 13. A. H. BUCK. Instrument for Application of Nitric Acid.
 14. HAGEN and STIMMEL. Die Untersuchung des Ohres im polarisirten Lichte. *Berliner Klinische Wochenschrift*, No. 48.
1. FOLLOWING the suggestions of Rüdinger, Dr. UTZ has entered into a more thorough investigation of the structure of the membranous semi-

circular canals of the human labyrinth, and has published the same in a handsome monograph illustrated by photo-lithographic plates.

The principal object of the work has been a careful study of the structures occurring in this organ, termed papillæ by Rüdinger, with the object of determining, so far as possible, their nature, whether normal or pathological. The subject treated is the more interesting that the physiological experiments instituted by Flourens and followed by Harless, Goltz, Mach, Bruer and others, have led to the conclusion that the membranous semicircular canals are an organ of equilibrium.

Schiff and latterly Boettcher are of contrary opinion, the latter believing that the greater part of the symptoms observed by Goltz are the result of injury consequent on the method of operation, and that the assumption that the semicircular canals constitute a special organ of equilibrium is not supported by the facts in the case. As compared with the numerous experiments concerning the physiological value of the membranous semicircular canals, the works which treat of the anatomical, the histological structure of these organs are few in number. Of these the principal are the investigations of Rüdinger* and of Lucæ.† The former is of the opinion that the papillæ in question are normal structures, and supports this view on the ground of their constant presence in the semicircular canals of all adults. The latter supports this statement, but believes Rüdinger's inference to be a mistake, and that the papillæ are really pathological, because they are not found at all ages, because they lack the epithelium which is found on the whole of that part of the inner surface of the canal which is wanting in papillæ, and because the isolated papillæ give the recognized amyllum reaction with iodine. In a later communication Rüdinger denies the absence of epithelium, and remarks with regard to the reaction with iodine that this is also peculiar to other structures in which amyllum has not yet been detected. Voltolini has also investigated these structures and considers them enlargements of the epithelium.

Following these remarks, which form in part a preface to the work, the author gives first the method of examination. The structure of the semicircular canals, the various coats and their relations to each other, and especially the number and size of the papillæ, are best shown on cross sections, as recommended by Rüdinger. The preparation of the specimen for microscopic examination consists first in soaking the temporal bone in alcohol for several days. The removal of the membranous canals is

* Das häutige Labyrinth. Handbuch der Lehre von den Geweben. Stricker, 1871.

† Ueber eigenthümliche in den häutigen halbzirkelförmigen Kanälen des menschlichen Ohres vorkommende Gebilde. Virchow's Archiv, Band XXXV.

more easily effected, and they are in better condition to afford good cross-sections. They should be removed and preserved as far as is possible *in continuo*, as it is very important to be able to identify the portion of the canal from which the section is taken. After removal, the canals must remain in alcohol long enough to secure the degree of elasticity and resistance necessary to preservation of their form after section. The sections should be made by means of fine scissors, as nearly as possible at a right angle to the long axis of the canal, and in fluid (preferably alcohol), which will allow the canal to resume nearly its normal form after section, and will avoid the changes resulting from continued pressure which might lead to error.

The prepared sections are mounted in glycerine. The following chapter is devoted to general description of the structure and position of the membranous semicircular canals, and a separate heading is given to the more minute description of the three coats, the outer or connective tissue coat, the middle coat or tunica propria, and the inner or epithelial coat. The sections on which these descriptions have been based are preferably those of new-born infants, in which no papillæ are found, according to the author, although Lucæ claims to have met with them, and considers otitis media in the new-born infant a principal cause of the occurrence of these structures. Among the specimens examined by Utz were several from children who had suffered from this affection, but careful examination failed to detect the papillæ in any case. Under a high power the cross-section appears as an oval ring with an irregular contour externally, resulting from the attachments to the periosteum torn away in removal of the membranous canal, the surface directed toward the free cavity of the osseous canal being smooth. Under a still higher power the three coats may be plainly distinguished.

The outer coat consists of connective tissue intermingled with numberless round or oval cells; there are also elastic fibres and numerous blood-vessels. It varies in thickness, being thinner on that portion of the canal contiguous to the bone, thicker on the free side of the membranous canal, and thickest at the point where the processes above mentioned pass into the periosteum. The resemblance of this coat to the periosteum favors the conclusion that this coat is simply the periosteum of the osseous canal, which at this point divides into two layers, enclosing the membranous canal between them. This view is further supported by a consideration of the development of the parts. In the embryo the whole osseous canal is filled with a gelatinous mass permeated by blood-vessels; in this, on the convex side of the osseous canal, the membranous canal is embedded. The gelatinous mass gradually

disperses, openings appearing in it, which enlarge until finally there remain only the periosteum, the outer coat of the membranous canal, and in addition a few bands of connective tissue which surround the blood-vessels passing between the periosteum and outer coat of the canal.

Before the entire recession of the gelatinous mass is completed, the bands of connective tissue are very numerous and so united as to form a delicate net-work throughout the mass.

Where the periosteum divides to surround the membranous canal there are large openings containing the principal blood-vessels, which send off lateral branches to the sides of the canal. The rounded cells, which are apparent in the periosteum and in the connective tissue, especially numerous on the free side of the canal, might, from their resemblance to epithelial cells, lead to the belief that the periosteum and outer coat of the canal possessed an epithelial covering, but careful examination does not support this view.

The second or middle coat, the transparent vitreous, tunica propria, can only be satisfactorily studied on cross-section, and then appears structureless, transparent, and colorless. The transverse marking which Lucae observed in this coat, the author observed only in such preparations as were insufficiently hardened, and he believes them, therefore, to be merely accidental. The tunica propria varies also in thickness, and its outline is clearly distinguishable from that of the outer coat. The observation of Kölliker, that after treatment with acetic acid numerous cells appeared in the tunica propria, is not supported by the author, and his explanation of this phenomenon is that the swelling of the parts after action of the acetic acid, by confounding the boundaries of the two coats, led to this appearance. The inner surface of the tunica propria is covered by the third or epithelial coat, presenting the characteristics of pavement epithelium. The single cells are small, nucleated, and packed closely together, and so intimately connected that in some places they may be raised from the subjacent tissue like a separate membrane. In its later development the tunica propria presents marked changes, not in its structure, which remains the same, but in the form of the surface directed toward the cavity of the membranous canal.

This surface, which in the new-born infant is perfectly smooth, loses this characteristic in children of even a few months; it is then irregularly rugose, especially on the free wall of the canal. The earliest age at which this appearance was noticed was four and a half months. In older subjects it was still more marked. In a male sixteen years of age the papillæ presented all possible forms, and increased in size and number proportionately with the age of the subjects examined.

Their character and structure correspond exactly with that of the tunica propria, from which they project, and with which they are identical. They are colorless and transparent, and sharply outlined on the surface directed toward the cavity of the membranous canal.* The opinion which has been advanced, that there is a boundary between the tunica propria and the papillæ, is explained by Utz. In a thin section there is not one row but several rows of papillæ one behind the other, separated by a depression in the surface. The bottom of such a depression appears, on profile view, as a line, seen through the transparent bases of the papillæ and simulating a division between the papillæ and the tunica propria. The papillæ are not distributed equally throughout the canals, but vary in size and number in different locations. On the upper surface, that portion of the canal contiguous to the bone, where the tunica propria is the thinnest, they never occur.† On the free wall they are well developed in size and number in adults, but the author has never found them in any case under sixteen years of age; they are largest and most numerous on the lateral walls of the canal. They develop first in the middle of the canal, considered as a whole, and progress toward the two ends, so that in a male six years of age the middle of the canal showed well-developed papillæ, while the two ends were free. In the adult also they are larger and more numerous in the middle of the canal and occur on all three walls, while at the beginning and end of the canal they are smaller, less numerous, on the free wall are almost wanting, and on the lateral walls so united as to be barely distinguishable. General affections, as well as special disease of the ear, seemed to have no influence on the occurrence of the papillæ. The specimens examined by the author were taken from persons who had suffered from various acute and chronic disorders, and in no case was a variation from the usual development of these structures observable. The examination also of the semicircular canals of a deaf-mute revealed the same general appearances. In the chapter on the epithelium of the inner wall in the adult, the author reviews the statement of Lucæ that the tips of the papillæ are free of epithelium, explaining it on the ground that the epithelial layer, as already stated, is easily raised from its subjacent tissue, and the appearance described by Lucæ may be, therefore, the result of mechanical interference in preparation. Utz therefore concludes, from the constant occurrence of the papillæ in all adults, from their regular distribution throughout the canals, and from their development, which

* Lucæ denies this sharp outline to all the papillæ. Utz maintains that it is always observable in successful sections.

† The so-called papillenfreie Wand of Rüdinger.

may be progressively studied, that they are normal structures, and, as regards their physiological import, without reference to either of the two theories concerning the office of the semicircular canals, that the papillæ serve to modify the movement of the endolymph in the membranous semicircular canals.

II. The comparatively rare opportunity afforded for examination of the Eustachian tube of the elephant has induced Dr. ZUCKERKANDL to record his observations, although unfortunately only a portion of the subject could be obtained, sufficient however to form the basis for a very interesting communication.

The ostium pharyngeum tubæ is with difficulty found, as there is no projection on the pharyngeal wall to mark its position. The passage is very nearly vertical, and diminishes regularly in size from below upward throughout the portion examined, about two-thirds of the whole length of the tube. The ostium pharyngeum possesses no distinct cartilaginous boundary, but appears as an irregular and comparatively small slit, the thick lateral wall of which is considerably longer than the medial membranous side. Longitudinal sections made at various points in the tube show that near the pharyngeal end the lateral is much stouter than the medial wall; that the summit of the tube is embraced in a very resistant tissue, and that the medial wall increases rapidly in diameter laterally, while the lateral wall correspondingly diminishes.

The increase in thickness of the tubal cartilage is especially noticeable in the lower portion of the medial plate; this increases to a cylinder, which nearly surrounds the tube in its middle portion. The tube is fixed to the base of the skull by a comparatively slender basilar fibro-cartilage, which leaves the medial wall nearly free. The condition of the specimen unfortunately made it impossible to determine the anatomical characteristics of the cavity of the tube. The macroscopic structure of the tubal cartilage, however, presented considerable interest. It appears that only the apex of the tube possesses real homogeneous cartilage, which, in the shape of a groove, forms a portion of the medial and lateral walls; the remaining and by far longer portion of the tubal cartilage comprises three varieties, alternating and commingling. Primarily noticeable in the more or less fibrous matrix is an irregular network of fibres of varying size, frequently anastomosing, and connected with the apex of the tube. The peripheral walls of this cartilage network are bordered by delicate white lines, which form separate islands, as it were, on cross-section of the tube. The substance interlying the above-named tissues is more of a reddish-yellow color, presents a fibrous appearance, and is not so resistant as the hyaline tissue.

Microscopic examination shows that the various forms of cartilage tissue participate in the structure of the tube. Those portions which present the appearance of a hyaline cartilage are in fact formed partially of a structureless basis, thickly strewn with cartilage cells.

Other parts exhibit a meagre and delicate fibrous tissue, which extends beyond the boundary of the cartilage into the surrounding tissues. The soft, reddish-yellow tissue above described as interlying and surrounding the cartilage structures, and which receives numerous bundles of connective fibres from the white cartilage, is a cell-less connective-tissue cartilage, marked with a confusion of intermingling fibres.

III. In reply to the paper of Prof. Moos on dilatation of the bulb of the jugular vein, in which he traces a connection between such dilatation and psychical affections, RÜDINGER has published some observations. Out of one hundred human skulls Rüdinger found that in sixty-nine the right jugular foramen was the larger, in twenty-seven the left, and in four the two were equal. These results, except in the last point, correspond very fairly with those obtained by Dr. Dwight from a series of one hundred and fifty-nine skulls, of which one hundred and four had the foramen larger on the right, thirty-eight on the left, and seventeen presented no difference. Rüdinger shows that the difference between the two sides depends on the arrangement of the venous sinuses. He holds that there is no true confluence at the internal occipital protuberance, but that the superior longitudinal sinus carrying the blood from the surface of the hemispheres turns to the side of the larger foramen, usually the right, and that the straight sinus from the interior of the brain turns the other way. He admits, however, that there is a communication between the two.

Rüdinger's conclusions are :

1. That the jugular openings are unequally large and deep.
2. That this difference is not the result of any anomaly of the surrounding bones.
3. That, as above stated, it depends on the course of the circulation.
4. That a broad jugular fossa appears to be an individual peculiarity, in which neither the intra-cranial circulation nor the function of hearing is concerned.

IV. Dr. DWIGHT, in addition to the above review, says that he is unable to see on what the last conclusion is based, as his own observations show that of the one hundred and forty-two skulls which had the foramen larger on one side than on the other, ninety-three, or nearly two-thirds, had a more capacious fossa on the side corresponding to the larger foramen, while the fossa was larger on the side corresponding to the smaller foramen in only nineteen, or less than one-seventh.

V. A further contribution to the knowledge of the movements of the Eustachian tube is furnished by Dr. NICOLADONI in a case coming under his observation. The favorable opportunity for examination, and the previous progress on the same subject by Zaufal,* Zuckerkandl,† and others, render the case particularly interesting.

The patient, twenty-one years of age, had suffered for three years from difficulty of breathing through the right, latterly also respiration through the left nostril had become impaired. The configuration of the upper jaw had become somewhat changed. The right canine fossa had become obliterated, the lower rim of the right orbit projected, the nose was turned toward the left, and there was a slight exophthalmus. Under the mucous membrane of the right cheek was a tumor the size of a nut, readily movable, and fixed posteriorly. The row of upper teeth on the right side was pressed toward the median line, so that the arch of the alveolar process seemed more flat than normal. The soft palate was pressed forward, and on sounding the vowel *a*, as the palate lifted the lower border of a tumor of a rose-yellow color was revealed. Examination with the finger showed the whole naso-pharyngeal cavity to be filled by a smooth, lobulated tumor, free anteriorly, posteriorly, and toward the left side of the cavity.

The septum marium was pressed toward the left, so far indeed that the left nasal passage was represented by a slit from 2''' to 3''' wide.

This tumor hung from the right pterygoid process and the anterior portion of the right pharyngeal wall, and so filled the right nasal passage that it was possible to introduce a probe only by closely hugging the wall of the septum. The operation consisted in removal of the right upper jaw, leaving the palatine and alveolar processes.

After removal of the facial surface of the upper jaw with a portion of the tuber maxillæ superioris, a tumor lying within the antrum of Highmore coming away with it, a view was obtained of the right nasal cavity greatly enlarged, its anterior portion filled by a long fibrous tumor, the wider posterior portion being crowded by the principal mass of the tumor attached to the right pterygoid process by a broad base. The tumor was peeled away from the process and cut from the right pharyngeal wall with scissors, the bleeding, which was considerable, being checked by

* Zaufal. Besichtigung der Pharyngealmündung der Eustachischen Röhre durch die normale Nase. Aertzl. Correspondenzblatt, No. 24.

Die normalen Bewegungen der Rachenmündung der Eustachischen Röhre. Archiv f. Ohrenheilk., B. ix. 4, 3-4.

† Zuckerkandl. Zur Anatomie und Physiologie der Tuba Eustachiana. Monatsschr. f. Ohrenheilk., 11, 1874.

actual cautery. The tumor in the cheek was laid bare and followed to its base on the right pterygoid process, from which it was removed; it was of fibrous structure, and at its insertion of a loose porous tissue from which a quantity of dark blood was pressed.

After removal of the pharyngo-nasal tumor, which was about the size of a hen's egg, the enlargement of the right nasal fossa was exhibited, and advantage of the opportunity was taken to observe the movements of the Eustachian tube, the septum being pressed so far to the left that with good illumination it was possible to observe the whole of the left pharyngeal wall.

Simultaneously with the contact of the soft palate with the posterior pharyngeal wall, its posterior surface being almost in a line with the floor of the nasal cavity, the medial portion of the tube, about one centimetre in height, began its movement while the lateral portion appeared to remain at rest. The movement, which was rather rapidly performed, consisted in an elevation for about three millimetres of the lower prominent edge of the medial plate, which appeared also to be drawn backwards and slightly toward the median line, at the same time the lower boundary of the fossa of Rosenmüller became sharply marked and projected into the pharyngeal space, an arcus salpingo-pharyngeus, the apex of the tube, remained at rest. Blood accumulating on the left wall of the pharynx, and a bubble occurring over the opening of the Eustachian tube, it was interesting to notice that with each movement of swallowing the bubble sank into the depth of the Eustachian tube to reappear at the termination of the act of deglutition. The reviewer had opportunity to make a somewhat similar observation in a case in which the membrana tympani having been destroyed, and a thin and lax cicatrix having formed across the anterior portion of the tympanic cavity, cutting off all communication between the air in the remaining posterior portion of the tympanic cavity and that in the Eustachian tube, deglutition was accompanied by a movement of this cicatrix. At the commencement of the act of swallowing the lax cicatrix was forcibly extended, maintaining this position until the act was completed, when it sank back to its former place.

VI. Another case affording opportunity for investigation of the movements of the faucial portion of the Eustachian tube is added by MICHEL to those which he has already reported.

The patient, a young man twenty years of age, had suffered for thirteen years from disease of the nasal cavity, resulting in destruction of the septum. The removal of a large sequestrum exposed the whole of the naso-pharyngeal cavity; the orifices of both Eustachian tubes and the whole of the soft palate were plainly visible.

On swallowing, the whole of the posterior surface of the soft palate came into view, pressing laterally between the cartilage projections of the Eustachian tubes and posterior boundary of the nasal cavity into the openings of the Eustachian tubes, and rising convexly against the posterior pharyngeal wall.

Simultaneously the projections of cartilage were elevated, their lower borders approaching the centre of the cavity of the pharynx; while behind them, on the posterior pharyngeal wall, appeared two projections rising from 1 to $1\frac{1}{4}$ cm. above the surface of the palate and having a smooth surface 1 cm. wide between. On forcible deglutition this intermediate space disappeared and the mucous membrane presented additional folds. During phonation the appearance was much the same, except that a thick fold appeared on either side at the junction of the posterior and lateral pharyngeal walls. On sounding the vowel *a*, the palate was nearly flat, rising but little above the level of the floor of the nasal cavity; with *e*, *i*, *o*, and *u*, however, it was elevated considerably above that level.

The anterior border of the Eustachian opening remained nearly motionless, except that below it there appeared a slight fold* which was lost in the border of the palate, moving backward and forward during the act of swallowing. In order to study the movements of the Eustachian opening a mirror $1\frac{1}{2}$ cm. in diameter was passed through the nasal passage and the speculum passed upon it. When at rest the opening appeared as a furrow, the lower portion of which formed a triangle, the walls above lying in contact. The act of swallowing was accompanied by a wave-like motion on the floor of the orifice, then an elevation, the floor of the tube rising into the opening; and at the height of the act, the moment of greatest elevation of the floor, the furrow opened, presenting the appearance of a dark triangle, the apex of which was lost in a black line extending upward.

During phonation the cartilage projection of the tube moves backward, and its lower border is elevated by the upward pressure of the floor. The orifice opens only during singing of the high *i* or *e*, as with these vowels the palate is forcibly elevated and the floor of the Eustachian opening passed upward. On sounding these vowels both the cartilage projection and the velum vibrate forcibly, and the transmission of these vibrations to the osseous portion of the tube and to the ear may explain in great measure the singing sound heard on sounding and holding the high *i*.

* Plica salpingo-palatina of Luschka.

The cracking sound sometimes heard on swallowing may also be explained by the movement of the cartilage of the tube.

VII. One hundred and four out of the two hundred and fifty-eight pages of the work of Prof. BERNSTEIN are devoted to sound and hearing. The work as a whole is more thorough, and at the same time better suited to the comprehension of the general reader than are most of the rapidly multiplying books of this class. It is also clearly printed and well illustrated.

As a popular rather than a purely scientific work it would be out of place to present an intimate review of the several chapters devoted to the sense of hearing. The author's views in regard to the physiological value of different portions of the auditory apparatus, and comparison with the views of other writers, are clearly stated in language appropriate to a work of this kind, and enough is given of the minute anatomy of the ear to make the functional importance of the various structures clear to the reader.

VIII. The first part of Mr. FIELD'S paper, as read before the Harveian Society, is devoted to a definition of the term *tinnitus aurium*, to quotations from various authors, ancient and modern, as to its causes and importance as a symptom, and to an enumeration of various remedies, empirical or otherwise, which have been suggested for its relief. "I think," the author says, "the mischief can always be traced to the *membrana tympani*. We rarely find *tinnitus* present in cases of perforation from ulceration, and incising the membrane no doubt will afford relief if a permanent opening can be established." Where remedies applied to the removal of the supposed cause of the *tinnitus aurium* have proved inefficient, the author has employed Faradization, which he has rarely found to fail.

"In point of fact I have no hesitation in saying that Faradization applied directly to the tympanic membrane will either materially relieve the patient from the noise he has been suffering from or stop it altogether."

"With reference to electricity as a remedy for severe noises in the ear, I maintain that the good effect I have obtained is due to the stimulation of the intrinsic muscles of the ear, just as in other parts of the body paralysis is often overcome by the same means."

Seventeen cases are mentioned in which *tinnitus aurium*, more or less severe, disappeared after Faradization for a longer or shorter period. There is no detailed statement of other symptoms, and only a superficial description of the objective symptoms in any case. The author's investigations have been limited to the boundary of the lines in Hinton's appendix to Toynbee's work : "It seems better that the causes of *tinnitus* should be held as yet a very open question." His views as above given are submitted to the judgment of the reader.

IX. Dr. Theobald, on the other hand, enters into "a consideration of the causes upon which tinnitus aurium depends, and an attempt to explain its production in accordance with physical principles." The author goes still further than does v. Tröltsch, and says not only that subjective sounds in the ears are an expression of irritation of the auditory nerve, but that they are an expression of an excitation of the terminal or percipient elements of the auditory nerve only, and not of irritation of the nerve trunk. Tinnitus aurium is to be attributed in almost all cases, whether associated with aural affections, cerebral diseases, or constitutional disorders, to the existence of vibrations excited in the walls of the blood-vessels of the labyrinth by the friction attending the circulation of the blood.

The author's conclusions are, that the two modes by which the vibrations of the vessels of the labyrinth may be enabled to produce a sensible impression upon the auditory nerve are by increase of the amplitude of the vibrations, and the amplitude of the vibrations remaining unchanged by the increase of their effect upon the nerve, by reflection, concentration, or by resonance; in other words, the circulation in the blood-vessels of the labyrinth being the cause of the subjective noises, they may be increased so far as to become perceptible by any undue friction attending the movement of the blood, and this will happen when the normal relationship between the intra-vascular and intra-labyrinthine pressure is disturbed, or when, in any other way, the natural flow of the blood is perturbed, or by any change in the sound-transmitting portions of the ear which will return the sonorous vibrations resulting from the intra-labyrinthine circulation to the auditory nerve. "Those conditions of the sound-conducting apparatus which prohibit the entrance of sounds from without will also prevent the escape of sounds from within." The tinnitus accompanying catarrhal inflammation of the middle ear is explained on the above ground, and by the added effect which the accompanying intra-labyrinthine pressure may have upon the circulation.

X. A new method for inflation of the middle ear, recommended by Gruber, consists in a modification, or rather combination, of the use of the ordinary air douche and the Valsalvian experiment. The object being, where it is desirable, to dispense with the use of the catheter to close the upper portion of the pharyngeal cavity from below, and produce a pressure in the naso-pharyngeal space which shall extend to the middle ear. This may be accomplished by substituting for the act of swallowing the intonation of certain syllables or consonants which are accompanied by forcible elevation of the posterior portion of the tongue pressing the soft palate upward and backward against the posterior pharyngeal wall.

This movement is most pronounced on sounding the consonant *k* without the accompanying vowel sound. Simultaneously with the sounding of *k*, or, better still, *kk* by the patient, air is forced into the nostril by means of the balloon in the usual manner. By interposition of a vowel sound between the *k* and *k* closure of the naso-pharyngeal space is more effectual, and by interposing *a*, *e*, *i*, *o*, and *u* in succession, as, for instance, *hack*, *heck*, *hick*, *hock*, *huck*, the backward pressure of the tongue is effected in a regularly increasing ratio. By the use of these syllables a measure of the degree of pressure is therefore obtained, and by inclination of the patient's head to one side or the other, the air is forced into the ear which is uppermost.

XI. An interesting case of rupture of the membrana tympani is reported by Mr. HEWETSON, and is worthy of notice from the peculiar circumstance of its occurrence.

The patient, a man forty-eight years of age, applied for relief from deafness and severe tinnitus aurium. Inquiry elicited the fact that some four months previously the patient suffered from an unusually severe attack of vomiting, immediately following which he found that he could not hear his watch in the right ear, the hearing of which had always been previously good. On examination a small dark spot was discovered on the right membrana tympani midway between the long process and anterior edge of the membrane.

Air forced into the middle ear gave no perforation sound, but after syringing with warm water, inflation was accompanied by a sharp, hissing sound, and the dark spot, freed of the slight accumulation of secretion, exhibited a ragged opening, the edges of which were everted by the stream of issuing air. Tepid instillations of a solution of the bicarbonate of soda, followed by use of a three-grain solution of sulphate of zinc, resulted at the end of a week in closure of the opening, and consequent improvement in the hearing. It would have been interesting in the above case to have determined the comparative potency of the two Eustachian tubes, as the rupture was evidently the result of the sudden intra-tympanic pressure consequent on the forcible vomiting.

XII. Mr. FIELD proposes a modification of the Toynbee artificial membrana tympani, which shall make that instrument available for the application of medicated solutions. It consists in extending the wire one-quarter of an inch beyond the rubber membrane, and attaching a disc of fine flannel, between which and the rubber may be packed surgical cotton saturated with the medicated solution. The author claims for this instrument that the flannel gives the requisite pressure, the rubber assists vibration, and the cotton will allow of the continued application of any

remedy which the case may demand. The same objects have been attained in the experience of the reviewer by the simple use of surgical cotton properly moulded and packed.

XIII. An ingenious and at the same time a very simple method for application of nitric acid in cases of granulations occurring in the middle ear or auditory canal has been devised by Dr. BUCK.

One of the difficulties attending the use of this acid, when applied on the cotton-tipped probe, has been the liberation of vapor within the canal, obscuring the view, and interfering with the proper application of the acid. This is obviated by using a small glass tube, in which runs a platinum wire. The wire, tipped with cotton and dipped in acid, is withdrawn within the glass tube, the end of which is then pressed upon the spot to be cauterized, and the wire pushed forward. After the operation, the office cotton may be removed from the wire by burning.

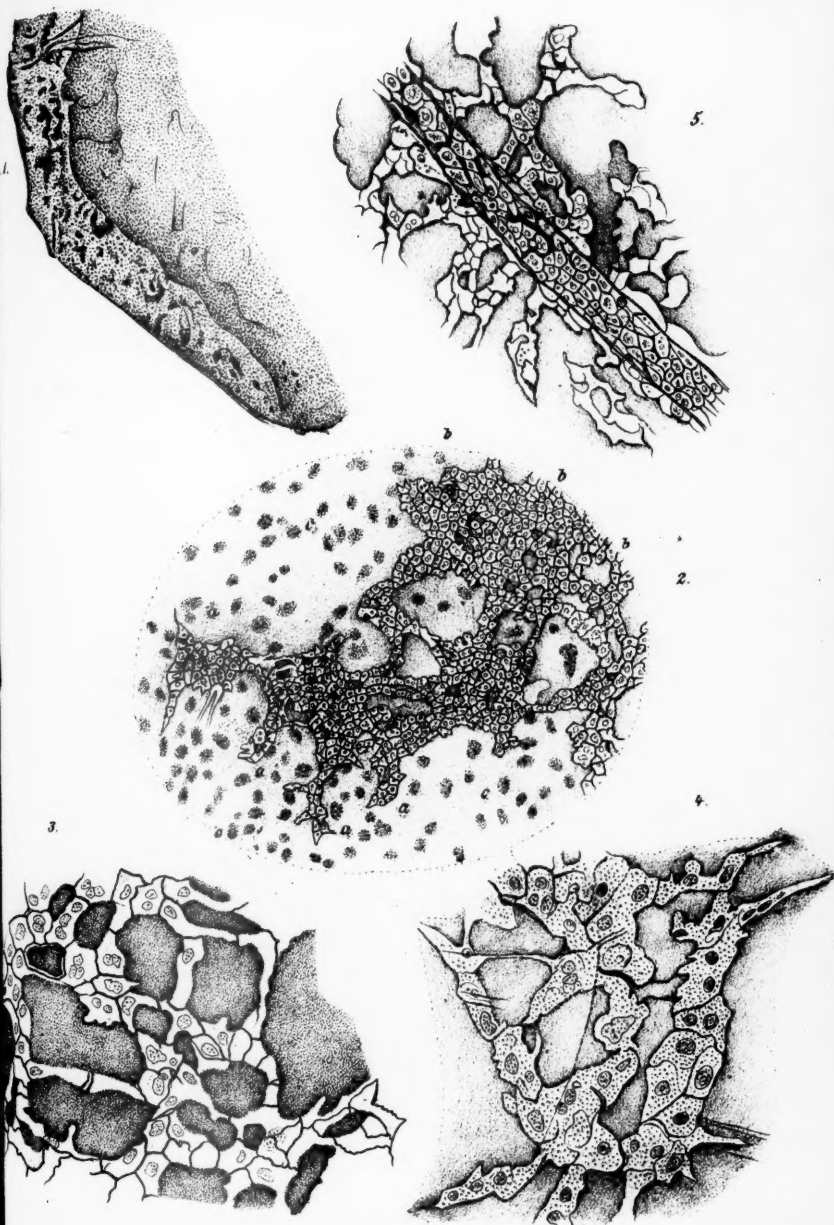
XIV. Incited by the interesting and successful experiments of Prof. Coccus on the examination of the eye in polarized light, Drs. HAGEN and STIMMEL have applied the same method of examination to the ear. The apparatus employed for the purpose consisted of a plane mirror of 13''' Par. diameter, having a central opening of 3''' Par. diameter, placed between two Nikol's prisms, each of which, surrounded by cork, was contained in a brass case. The mirror was surrounded by a metal ring having joints at two opposite points, one of which united the mirror with the metal case of the large Nikol prism, and allowed the mirror to be placed at various angles to the large prism. The opposite joint united the mirror to the smaller metal case of the second prism which was placed behind it. The case was set obliquely from left to right in such a position, that the smaller prism, with each change in position of the mirror, could be placed vertically to the central opening of the latter. The smaller prism, furthermore, was movable in its metal case, so that, during examination, its plane of polarization could be placed at right angles to the plane of polarization of the larger prism. The authors also found it of advantage to add a ball and socket joint at the lower portion of the ring holding the mirror for attachment of a twelve-inch convex lens. By placing this lens over the face of the mirror, the latter was converted into a concave mirror of six inches focus, and, by placing the lens behind the mirror, it served to enlarge the picture, while, in order to examine with the mirror alone, it was only necessary to turn the lens downward. The strong illumination necessary for this method of examination was furnished by a Tobold lamp. The lamp was placed at the left of the observer at the height of the ear under examination, and in such position that the column of light passed close to the ear at right

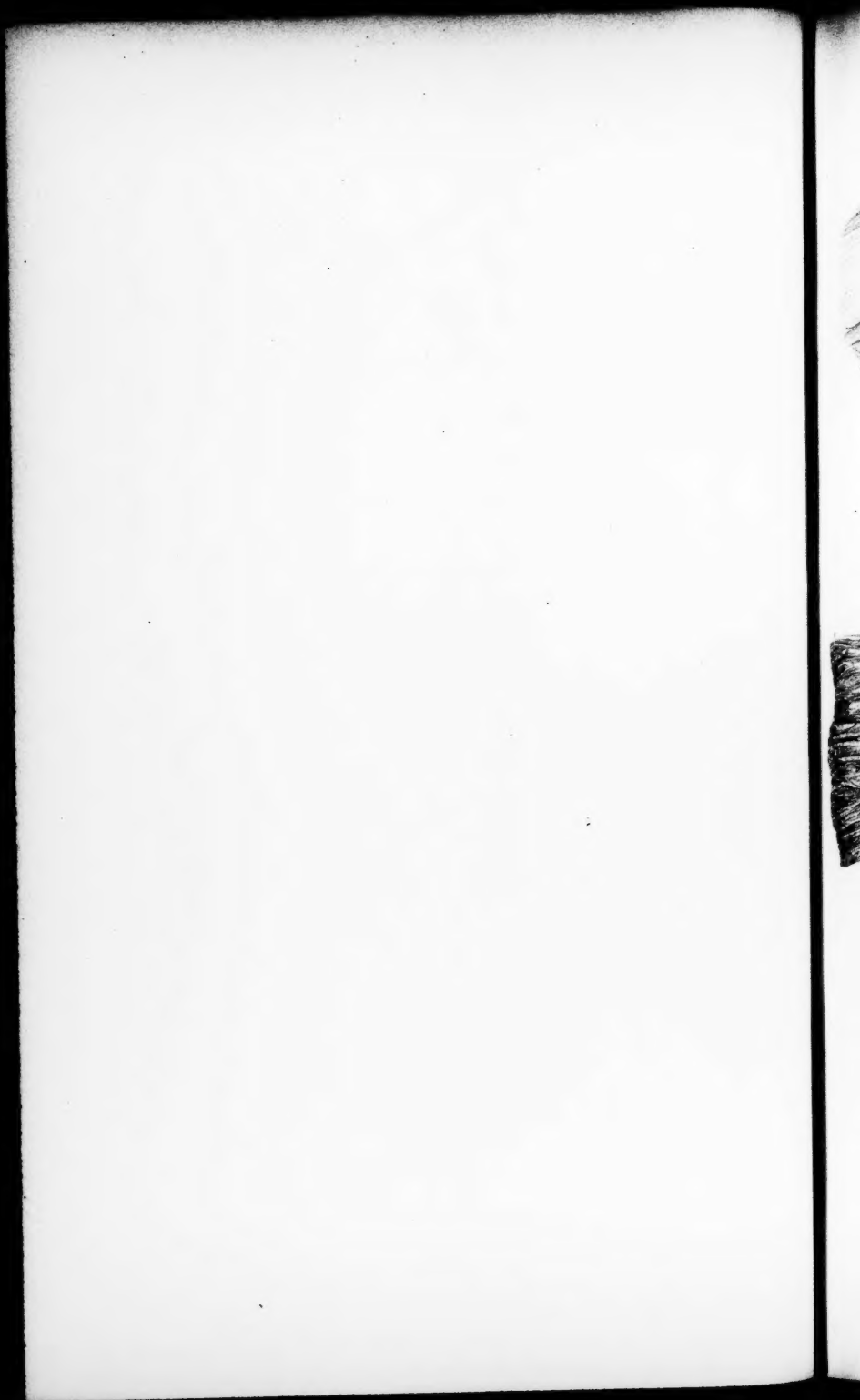
angles to the long axis of the meatus. An ordinary speculum was placed in the ear and held by an assistant. With the left hand, the larger prism was placed at a distance of about half an inch from the opening of the Tobold lamp, while the right hand seized the smaller prism placed behind the mirror, and set the latter at an angle of about 45° to the larger prism. The instrument was held nearly horizontal, so that the light from the lamp, passing through the larger prism or polarizer, fell upon the mirror and was reflected into the ear. On examination, under these circumstances, the ear presented the usual appearance, but, on placing the smaller prism or analyzer behind the mirror, and bringing its plane into position by turning the metal case, the effect of polarization was produced, the light returning from the membrana tympani through the opening in the mirror passing through the analyzer before reaching the eye.

Under these circumstances the following changes in the appearance of the membrana tympani are observable: The delicate lustre which overspreads the normal membrana tympani is wanting; the light reflex disappears; the location of the light reflex, however, is of a bluish-white color, and somewhat lighter than the adjacent parts; the explanation of this is probably that the light rays returning from this portion of the membrana tympani are largely absorbed by the polarizing mirror; other light-spots upon the surface of the membrana tympani, and the reflections from fluids in the meatus or on the membrana tympani, also disappear.

Transparent portions of the membrana tympani, moreover, may apparently be made entirely to disappear. A very common condition was the entire disappearance of the posterior superior segment, rendering the long process of the incus and portions of the stapes and promontorium visible. Other portions of the membrana tympani presented the appearance of a delicate veil. It was also possible to determine the presence of adhesions and pseudo-ligaments in the tympanic cavity. All opacities of the membrana tympani, such as calcareous deposits, ecchymoses, and the like, appear more distinctly defined, and the blood-vessels of the manubrial plexus were more clearly visible.

Enough has been done, as shown by the above short review of the results arrived at by the observers, to demonstrate the advisability of further experiment upon the use of polarized light in examination of the ear; and the suggestions thrown out in their paper as to examination of the movements of the ossicula and of morbid appearances, such as serous or purulent accumulations within the middle ear and the various forms of opacity of the membrana tympani, point to a larger application of this means of illumination than that of a simple experimental test.





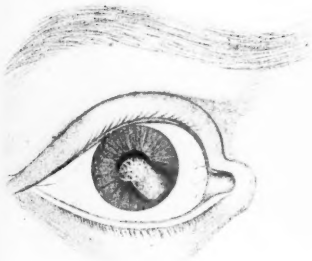


Fig. 1.

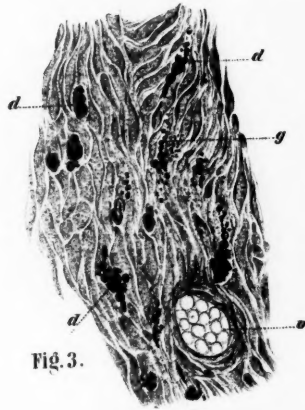
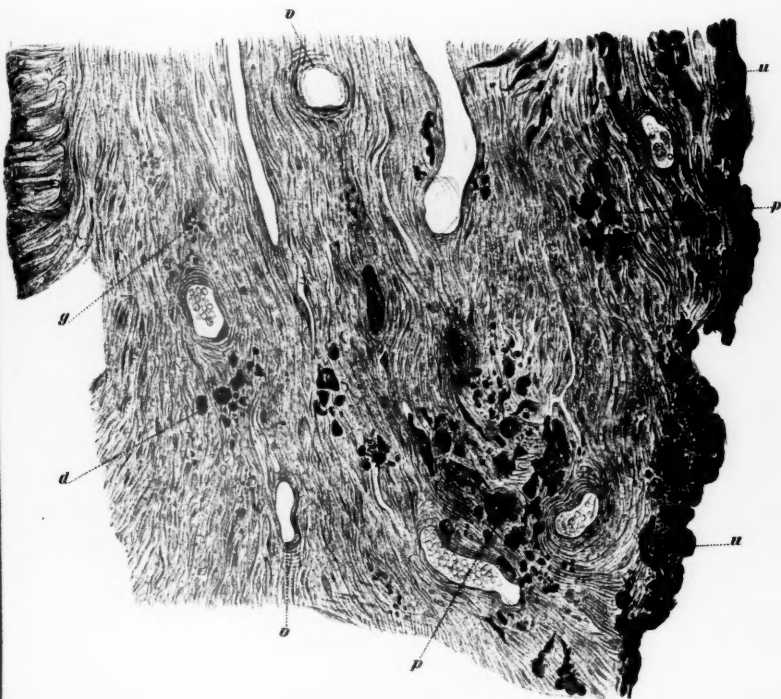
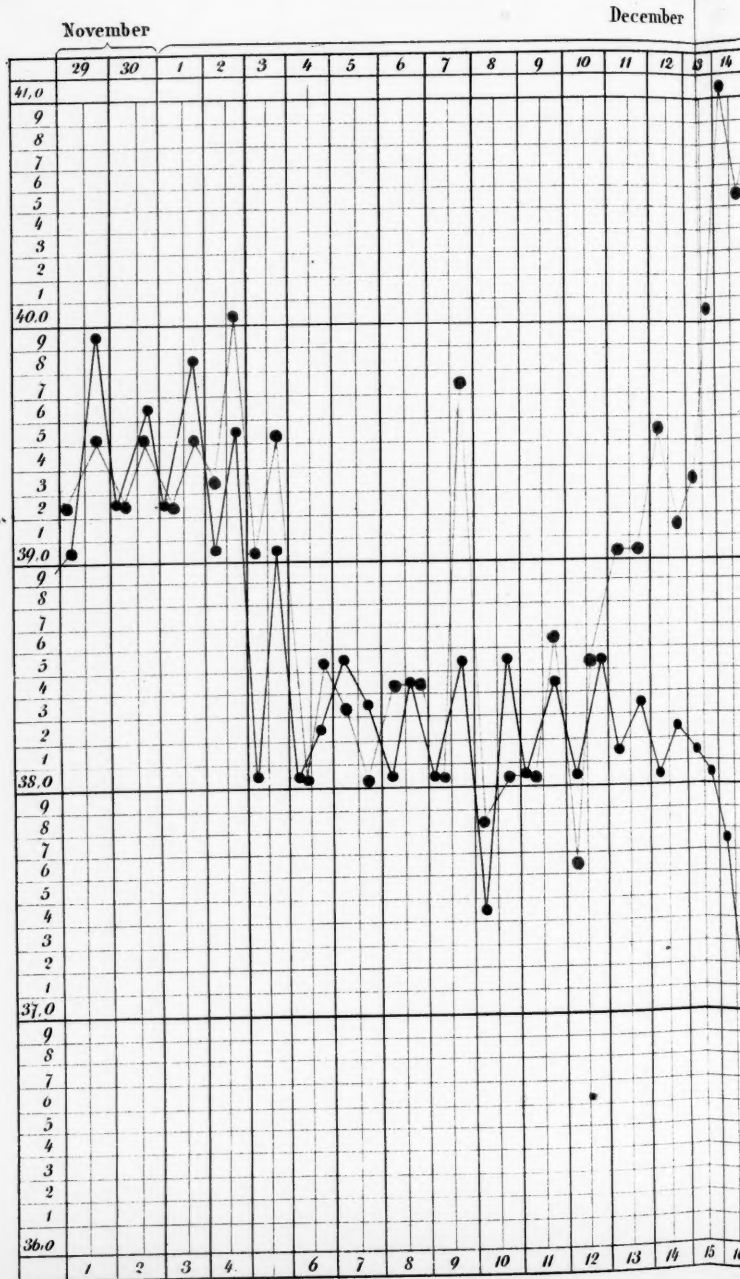


Fig. 3.

Fig. 2.



Comparative of two ear patients who died from abscess lateral ventricle



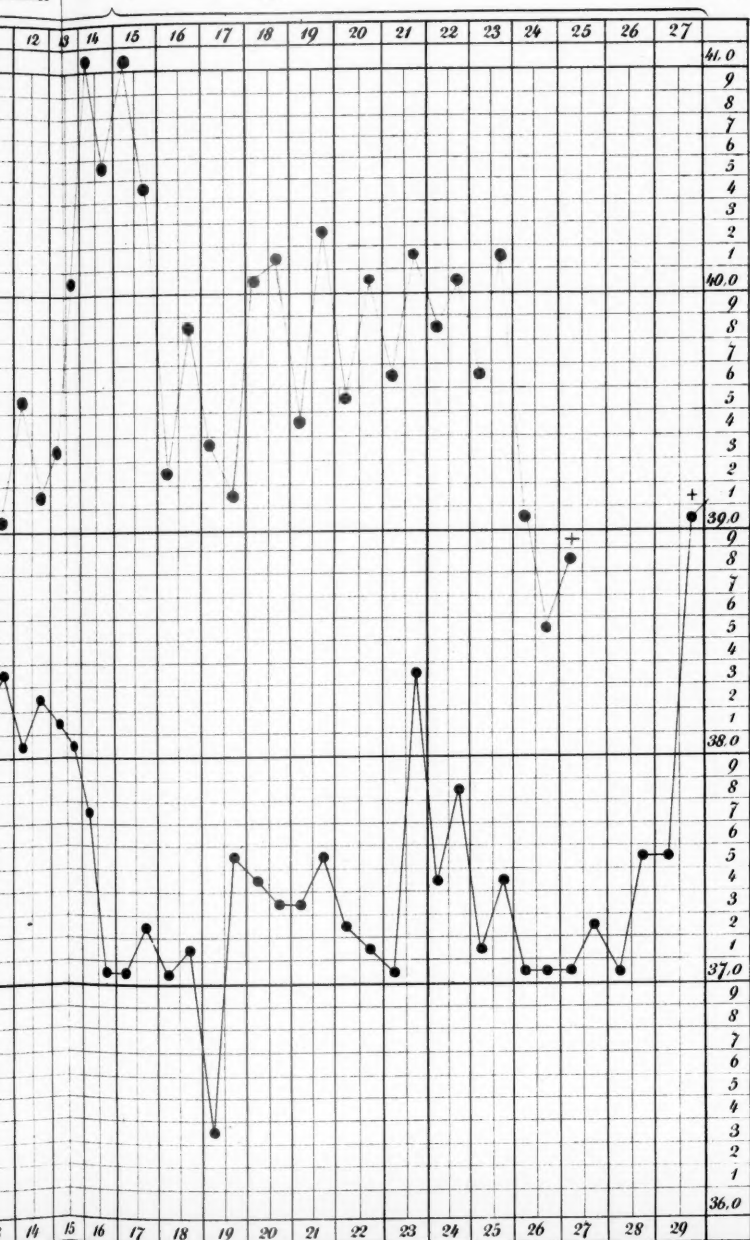
Comparative Fever table

ied from abscess of the brain with perforation into the lateral ventricle.

ember

1873.

Otol.Tab I.



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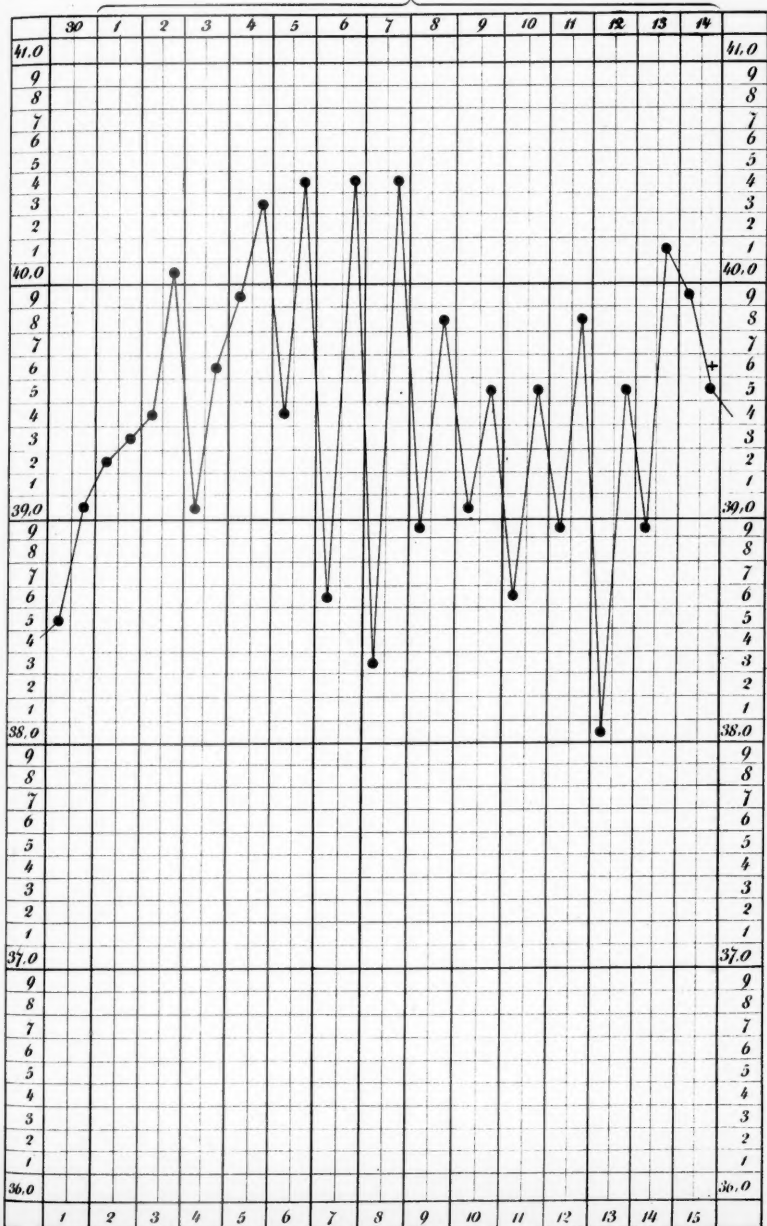
Fever table

of an ear patient who died from pyaemia ex phlebitide sinus
transversi.

Juli

1874.

Otol. Tab. II.



Luth. Anst. v. F. Wirtz, Darmstadt.

